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On the cover

How do they fit a complete movie, with studio quality video and 5.1-channel digital surround sound, on a 120mm DVD the same size as a CD? Find out in Jim Rowe's article starting on page 20 — which also explains about their controversial region coding system. (Photo by Michael Pugh)

Professional Electronics

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Letters to the Editor

Electronics clubs?

My almost eleven year old son has a very keen interest in electronics and digital watches and I can't find any help in finding a club for him to join. After purchasing your *Basic Electronics* book, I thought you may be able to shed some light on any groups or clubs that may be able to help him pursue his interests before he loses interest altogether because he can't get any help.

We live on the Sunshine Coast near Maroochydore and haven't been able to get any information from Dick Smiths or Tandy Electronics. We hope you may be able to help.

Paul Shiel (SHIEL@bigpond.com)

Preserving tapes

I found your article on sound preservation in December's *EA* most interesting. I have been involved in tape recording for the past 38 years and I still have some playable BASF tapes of that age. For 33 of those years I lived in Cairns, and I kept valuable tapes and amateur films sealed in plastic bags about the size of a pillow case with about 200g of silica gel in a small calico bag inside each plastic bag. The silica gel bags had a clear plastic window so it was easy to see when the gel had turned pink. Cairns is very hot and humid in summer and such protection was necessary to avoid fungal growth.

Less important tapes were not so protected, and I found that some not often played had decomposed chemically to the point of having to be thrown out. In any case 1/4" reel to reel tapes which had not been played for a month or so required cleaning before they could be played. My method of cleaning has been quite effective, though its crudity might offend your NFSA experts.

I simply thread the tape directly from one spool to the other, bypassing the heads. Fold a sheet of soft Kleenex tissue into a strip about 2cm wide, then hold it gently between thumb and forefinger both sides of the tape in the space between the spools. Run fast forward, but keep a finger on the Stop button. You can feel the friction build up, and on a dirty tape you may have to stop after five to 10 seconds. You can see the brown mark on the tissue, so you move to a fresh part of the strip and repeat, *ad nauseam*, *ad infinitum* whatever. Unfolding and refolding allows the whole surface of the tissue to be used. When the full length of the tape has gone through, swap reels over and go through again, in effect cleaning in the opposite direction. Repeat until no significant brown marks appear on the tissue.

Now that I am living in Brisbane, I have not had a fungus problem with my tapes, and am using hifi stereo video tape as my primary sound recording medium. About four months ago I acquired a computer with 4GB hard disc and a AWE-64 Sound Blaster card. Ultimately I intend to make my own CD's from the hifi stereo video tape recordings.

With the computer, I am on a steep learning curve. So far I have learnt to operate Creative Wave Studio to the extent of being able to do fades, insertions, take out glitches, and copy and paste from one file to another. However, being inexperienced with computers I obviously have a lot more to learn. The strange double cursors and rectangles which appear in the lower part of the window when I click there are still a mystery to me. Can anybody enlighten me?

Gus Harvey, Brisbane (by e-mail)

CD-ROMs and DOS

In the January issue Computer Clinic referred to the problems that can be encountered trying to get a CD-ROM drive going on some computers, in DOS.

My personal solution is simple: All of my computers have been bought already set up. This means that all drivers are present. I have taken note of the location, names of the CD-ROM drivers, and the way that they appear in the autoexec.bat/dos file and config.sys/dos files (some Win 95 computers don't have these). With this information I have made 'startup' (boot) disks (floppy) and copied the two files required to run the CD to the boot disk. The required files are MSCDEX.EXE and the CD driver (eg. Atapi-cd.sys). These files are then stored in a separate folder on the boot disk.

Once this is done, valid Autoexec.bat and Config.sys files for 'C Drive' are constructed and copied to the boot disks folder (syntax is important). This then means that, if you are prepared, the

prepared files will load the CD-ROM drivers on bootup. You then type [drive]\setup and Win95 will start loading from the DOS prompt.

Another benefit of this method is that you can set the boot disk up so that after formatting of the hard drive, the CD-files and Folders can be copied directly to the computer (including an appropriate autoexec.bat and config.sys) and the Windows setup run from DOS (after rebooting to load them).

Hope this info is of use.

Marc Chick (by e-mail)

Totally false!

In the article Home Theatre without Fears (February 1999 issue) a comment is made by the author on page 16 regarding DVDs: *Unfortunately their regional coding scheme also means that you cannot even bring in discs from the USA, unless you also import your own 'Region 1' player as well...*

I would like to point out to Jim Rowe that the above statement is totally false, and I am surprised a person of his knowledge in the electronics field can make such a statement.

First, most players sold in Australasia are code free players and if not can be modified to be so. Also it's not illegal to modify your own player.

Second, it's also not illegal to bring in your own discs in from the States for your own use; as a matter of fact most of mine are from the states. But it is illegal to sell region 1 discs in Australia.

If Mr Rowe was to logon to the internet he would see since December 98 the number of discs that are R4 has indeed grown, with more on the way. A good Aussie site is **http://www.dvd.net.au**, with links to other Oz sites...

Laurie Fava (by e-mail)

Comment: I actually wrote the article concerned in early December, Mr Fava. However it has certainly been good to see that more Region 4 DVD discs have been released since then. ❖

Editorial Viewpoint

DVD and its region coding: how *could* I be so naive or ignorant?

I'VE BEEN DELIGHTED to receive quite a strong response to my recent references to the problems associated with region coding of DVD video discs, even though most of the letters and e-mails have been critical. At least it shows that people are reading the magazine, and even these leaders!

It's also been interesting to note that by and large, the responses have tended to fall into two categories. First, there were the people who asked why I was spending so much time complaining about this particular aspect of DVDs, when *they* believed we hadn't yet done enough to help them understand what DVD technology was all about, and how it worked. Point taken — so in this issue, I've tried to remedy the situation with an introductory article on DVD. It starts on page 20, and hopefully it'll give you a satisfying insight into this exciting technology without bogging down in too many details.

The other strand of criticism has tended to come from readers who were already much more aware of DVD, and were amazed that I had referred to region coding without mentioning the availability of 'code free' or 'multi region' players (both here and overseas), and also the ability to import Region 1 coded discs via the Internet. Where had I been hiding with my head stuck in the sand, they wanted to know? Or perhaps I was simply naive...

Here's why I chose that approach. Frankly, I believed (and still do) that the region coding system is an extraneous complication for this otherwise excellent new technology, forcibly grafted onto it purely to maximise the profits of software producers — and inevitably placing consumers in the smaller and lower-priority 'regions' like our own at a serious disadvantage in terms of movie availability, compared with consumers in the USA's 'region 1'. However I also sensed that both the hardware and software producers were hoping to prevent adverse consumer reaction to this 'rigged game' coding system by keeping it as quiet as possible, and hoping that most people wouldn't notice.

Now it was clear that shrewder consumers had already twigged to what was going on, and decided to make their own arrangements. Hence the growth of websites with information on nobbling the coding locks in various DVD players, the gradual appearance of advertising offering pre-modified 'code free' or 'multi region' players, other websites offering online sales of region 1 discs, and so on.

So those already 'in the know' had already worked out ways to defeat the coding system, on an individual and private basis; they probably didn't need me to tell them what to do. But in my opinion, that still wasn't going to help the ordinary consumer in countries like Australia and New Zealand, who would be forced by default to accept this unwelcome restriction to their rights.

It seemed to me that the best way I could help, at least initially, was to draw as much attention as possible to the region coding system itself, so that as many potential consumers as possible would be aware of it and its likely impact on them. Only then would they be in a position to voice their objections and exert maximum pressure on the software producers — and perhaps if enough people did so, Hollywood's moguls might quietly let the system drop into well deserved oblivion. Perhaps I *was* naive. What do *you* think?

Jim Rowe

WHAT'S new
in the ever-changing world of electronics

Low cost megapixel digital colour camera

The CMOS Pro is a low cost megapixel digital colour/mono camera claimed to deliver images that rival the quality of other digital cameras costing as much as 5 to 10 times the cost. It's also claimed as the first camera to offer CMOS (complementary metal-oxide semiconductor) active-pixel sensor technology in a high resolution still camera delivering a true 800 x 1000 pixel resolution (uninterpolated).

The CMOS sensor in the camera provides 10 bits of dynamic range per colour channel, producing 2.4 megapixel files of RGB data. The active-pixel feature of the sensor allows capture of specular highlights on highly reflective objects without the 'blooming' typically seen with CCD sensors.

The camera can be purchased with a colour sensor for capturing full colour images from moving subjects, or with a monochrome sensor and a rotating RGB colour filter wheel for the highest resolution images of still subjects, as well as for capturing monochrome images of moving subjects.

The camera connects to a PC running Windows 95 via a high speed ECP parallel port or Power Macintosh via SCSI. Also available with the CMOS Pro is a TWAIN-compatible software module that allows the camera to be operated as an 'acquire' module from popular image manipulation software applications.

A variety of camera configurations are available, all the way up to the CMOS Pro Studio system that includes the camera and all cables, the TWAIN software module, a 12.5mm, f/1.3 lens (which is the equivalent of a 35mm lens on a 35mm film camera), a 50mm f/1.3 lens, and a set of extension tubes (0.5, 3, 5, 10, and 20mm) for macrophotography.

For more information circle **147** on the reader service card or contact Scitech, 155 Plenty Road, Preston 3072.

Improved speakers for mobile audio

Pioneer says its new TS-A range of car speakers solve many of the traditional problems in achieving optimum performance in this 'difficult' audio environment. A feature of the new TS-A1678, TS-A1668 and TS-A1648 is their distinctive gold cones, formed from injection-moulded polypropylene (IMPP) and offering improved response and higher output capability.

Another feature of the 160mm flush-mount speakers is their tweeter performance. Each driver includes a dome tweeter which is claimed to provide excellent 'off-axis' HF response, even when mounted low in the front doors of a car.

Top of the range is the TS-A1678, a two-way speaker with 180W power handling, featuring a 23mm soft-dome tweeter that 'swivels' to help solve response problems. This model has an RRP of $179, with $149 for the TS-A1668 and $129 for the TS-A1648.

For more information circle **146** on the reader service card or contact Pioneer Electronics Australia, 178-184 Boundary Road, Braeside 3195.

World's smallest 2.3 million pixel digital camera

Fujifilm has just released in the US its new MX-2700 digital still camera, claimed to set a new standard in megapixel resolution and size. The camera measures only 96 x 78 x 33mm and weighs a mere 240 grams, yet offers an image resolution of 1800 x 1200 pixels (2.3M pixels) — which at 300dpi can be enlarged to photo-quality 6" x 4" prints.

Images are stored on postage-stamp sized SmartMedia memory cards, and the camera is powered by a rechargeable lithium ion battery. The camera includes both a video output and serial port for downloading images to a computer, but for faster downloading an optional USB memory card reader is available. Other features include a 50mm polysilicon colour LCD monitor with 130,000 pixel resolution, built-in flash and digital 2.5x telephoto mode for closeups.

Australian electrostatic speakers break $3000 barrier

Victorian firm Vass Electronics has added to its range of Australian-made electrostatic loudspeakers with the release of a new model known as the ELS-5 Full Range Electrostatic. The new model is 2.2 metres tall and weighs a hefty 35kg, but is only 0.4m square at its base to minimise floor space required. Even more impressive is the price, a pacesetting $2990 RRP.

The unit is based on two identical electrostatic panels with mechanically separated bass and treble sections. The ultra-thin electrostatic diaphragm has a moving mass equivalent to a sheet of air less than 3mm thick. The frame is constructed from 32mm natural timber. It is claimed that the unit produces a well sustained bass response with the legendary clarity and presence that only a true electrostatic loudspeaker can produce.

Vass' director Charles Van Dongen says that "The ELS-5 represents the best value electrostatic loudspeaker available today, and if volume sales are sustained the price will be held at $2990".

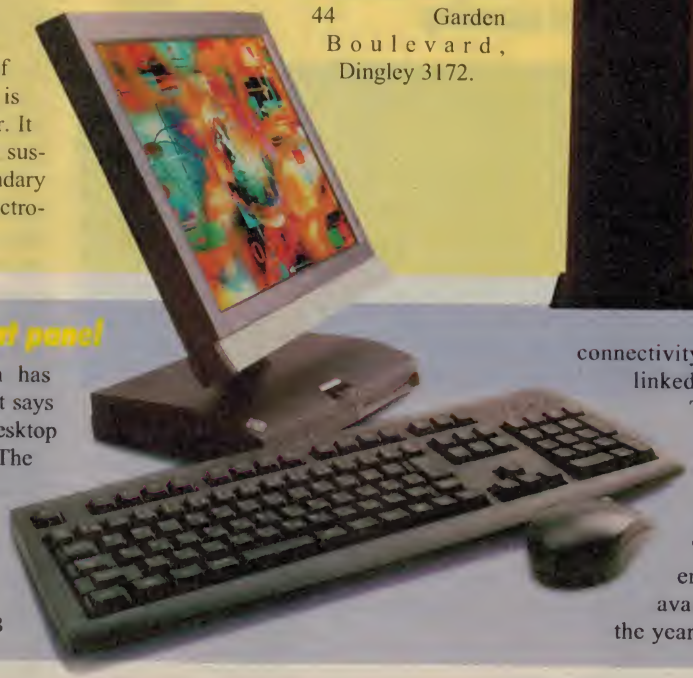
A wide selection of custom timber finishes are available. Other Vass models are priced from $6990 to $25,000.

For more information circle **141** on the reader service card or contact Vass Electronics at 1/42-44 Garden Boulevard, Dingley 3172.

New look desktop PC has flat panel

NEC's Computer Systems Division has revealed this new desktop PC, which it says represents the logical convergence of desktop and notebook computer technology. The new NEC 'Millenium' model is a complete self-contained system with integrated flat-panel display, and with a footprint of only 267 x 196 x 50mm.

Based on Intel's new Pentium III processor, the computer uses USB connectivity which allows it to be linked with up to 128 devices. The LCD screen can be detached for operating flexibility, and the new machine is claimed as the first of a new breed of 'microdesktop' computers. It's expected to become available in the USA later in the year for around US$2000.



AV receivers decode both DD & DTS

Two new home theatre receivers from Yamaha provide inbuilt decoding for DTS compressed digital sound tracks, as well as Dolby Digital 5.1-channel decoding. The new models are the RX-V2095 (RRP $2999 in black or $3299 in gold) and the RX-V995 (RRP $2199).

The RX-V2095 replaces the RX-V2092 as Yamaha's flagship receiver. In addition to DTS processing, it adds new soundfields (including the Bottom Line Club in New York), new entertainment modes, and Tri-Field Processing enhancements for DTS. The receiver has a total of 36 different soundfields. Other features include a newly developed Yamaha IC for Dolby Digital and DTS processing, a six-channel analog input so the RX-V2095 is ready for any other 5.1 channel format should one be developed, four digital inputs (four optical and two coaxial) and an optical digital output. In total, there are three audio and five video inputs, all of which have S-Video capability.

In addition, the new model provides automatic input priority selection. When different input formats are connected from the same source, the RX-V2095 automatically prioritises them and selects in order AC-3 RF, optical digital, coaxial digital, and finally, the analog input. The receiver also senses Dolby Digital and DTS signals and will automatically switch to the appropriate decoding mode when the signal is detected.

The receiver's seven-channel amplifier provides 100W to each of the five main home theatre channels and 25W to each of the additional front effects channels.

For further information, circle **140** on the reader service card or contact Yamaha Music Australia, 17-33 Market Street, South Melbourne 3205.

WHAT'S new in the ever-changing world of electronics

NAD receiver has Dolby Digital decoding

The larger of two new surround sound receivers from Britain's esteemed NAD Electronics, the new T770 features five full-range output channels of 70W rating, with peak current rating in excess of 40 amps. It also features a built-in Dolby Digital (AC-3) surround sound decoder, with a choice of digital inputs (coaxial, TOS Link or AC-3 RF), and the use of high quality Burr-Brown DACs (digital-analog converters) with 18-bit resolution.

In addition to the digital inputs and four analog audio inputs, the T770 also provides a 5.1-channel input for use with an external decoder (e.g., for DTS). Other facilities include pre-outs for all five main channels and subwoofer; five video inputs and two outputs, all with a choice of S-Video or composite.

The two DSP chips that handle the Dolby Digital, Dolby Pro Logic, EARS and other Surround Modes chosen are from the well renowned Motorola 56000 family. The combination of these components ensure that the integrity of the original signal, be it music or an action movie, retains its full resolution and dynamics.

A built-in noise generator (accessible by remote control) allows for accurate balancing/calibration of the front, centre and surround speakers.

For more information circle **142** on the reader service card or contact AWA Audio Products, 67 O'Riordan Street, Alexandria 2015.

Notebook PC has more functions

Sharp says its new PC-A100 UltraLite Notebook PC offers all the power of a desktop PC, the largest screen in its class (11.3") with over 65,000 colours, an 89% sized keyboard, up to eight and a half hours of battery life — and it all comes packaged in a ultra sleek, ultra light 1.40kg design that has often been compared to the size of a pad of A4 letter-sized paper.

Other features include an 11.3" active matrix SVGA TFT super bright LCD screen, a 233MHz Pentium Processor with MMX technology, 64MB EDO RAM and a 3.2GB hard disk. The full-powered notebook runs Windows 98, comes with an internal Li-ion battery and has an optional external Li-ion battery that extends operation from approximately two and a half hours to eight and a half hours. It also has an optional external CD-ROM available.

Also included are all the necessary ports: USB, VGA monitor, high-speed 4Mb/s IRDA infrared port, serial, printer, mouse/keyboard and external floppy disk drive.

The PC-A100 has an RRP of $3995 and is available in stores across Australia. For more information call Sharp on 1300 304 075.

Mini colour TV camera

Allthings Sales & Services now has available a digital signal processing Mini Video Surveillance Camera, suitable for C-mount interchangeable lenses. Ideal for discreet installations, it has a lightweight compact plastic case with top and bottom mounting points.

Main specifications are 400+ lines of horizontal resolution (better than VHS), a 1/4" CCD sensor with 297,984 active elements, automatic gain control, white balance and back light compensation, and an automatic electronic shutter giving speeds from 1/50 to 1/100,000 sec. Power requirements are 12V DC at 150mA via a 2.1mm DC socket, and output is standard 75-ohm composite video via a BNC socket. Accessories and options include C-mount lenses from 4 - 16mm focal length, polarising filters for glare reduction or exposure control and colour correction filters to compensate for 3600K and 4300K fluorescent lighting.

The cameras are priced from $189. For more information circle **144** on the reader service card or contact Allthings Sales & Services, PO Box 25, Westminster 6061.

Projector gives XGA resolution, 8000 lumens

Barco Projection Systems, the Belgium-based manufacturer of video, data and graphics display technology, has added another member to its new family of Digital Light-Valve projectors: the BarcoGraphics 9300, claimed to challenge the newest generation of high power DLP-based projectors, both in performance and in price.

The 9300 is equipped with an extremely powerful, state-of-the-art optical system driven by a new 1800W metal-halide lamp, which produces an amazing light output of 8000 lumens on screens up to 15m wide. Further, the 9300 has three 5.8" active matrix LCD panels with a resolution of 1024 x 768 pixels, plus a built-in Pixel Map Processor, which enables it to display all sources from VHS video up to 1280 x 1024 pixel workstations.

Other features include Barco's TCR or True Color Reproduction technology, which reduces noise in the video signal and improves the contrast ratio, and an optional Serial Digital Input using the 4:2:2 standard, for unsurpassed digital video quality. The projector is also available with Barco's Motorized Convergence Adjustment, which allows convergence alignments to be easily adjusted through the projector's on-screen menus.

For more information circle **145** on the reader service card or contact Barco Systems, Unit 6, 11 Lord Street, Botany 2019.

The Challis Report

This Year's Las Vegas CES - 1

Only just recovering from a visit to the mammoth 1999 Consumer Electronics Show in Las Vegas, Louis Challis realised that he didn't have a hope of packing all of his news and impressions into a single article. So here's the 'first half' of his report, dashed off in order to make the deadline for this issue.

A TRADE SHOW that can attract 150,000 visitors, with approximately half the attendees being from foreign countries, is obviously an exciting phenomenon. If the city wasn't Las Vegas, such an influx would be expected to saturate the accommodation and public services. But of course, Las Vegas isn't any ordinary city; its main purpose is to attract monumental crowds of gamblers, as well as other travellers, who are lured into this desert city by casinos and diverse 'nocturnal entertainment'.

The 1999 Winter Consumer Electronics Show (everybody just calls it the CES) was undoubtedly deserving of a multiple set of adjectives. Not only was the floor space larger than ever, but more excitingly the quality of the exhibits was markedly better than in previous years. One couldn't help but be impressed by the quality and breadth of innovation visible (and audible) from the specialist contract staff and myriad of entertainers, who competently showed off the new products to their best possible advantage.

> *"The 21st century will see an unparalleled convergence of video, audio and computer technologies..."*

Within the first half-an-hour of arriving at the CES, I had a clear impression (still unshaken) that the 21st century will see a consolidation and unparalleled convergence of video, audio and computer technologies. Many of the brochures, more of the lectures and even more of the special papers presented at the CES referred to the 1394 ('Firewire') Standard, which initially meant as little to me as it probably means to you.

It appears that a number of the consumer electronic giants, including Sony, Mitsubishi, Samsung, NEC and Yamaha have joined forces with some of the computer giants — most notably Microsoft, Intel and Compaq. Their avowed aim is to ensure that there is a common, effective and flexible digital interface between the next generation of consumer electronics and both the future, as well as the latest generation of computers.

The much-touted 1394 Standard will initially provide the critical link between digital television sets (which are already on sale in America) and the DTV set-top boxes that will facilitate a consumer's ability to interface a computer or their existing analog TV set with the new DTV signals.

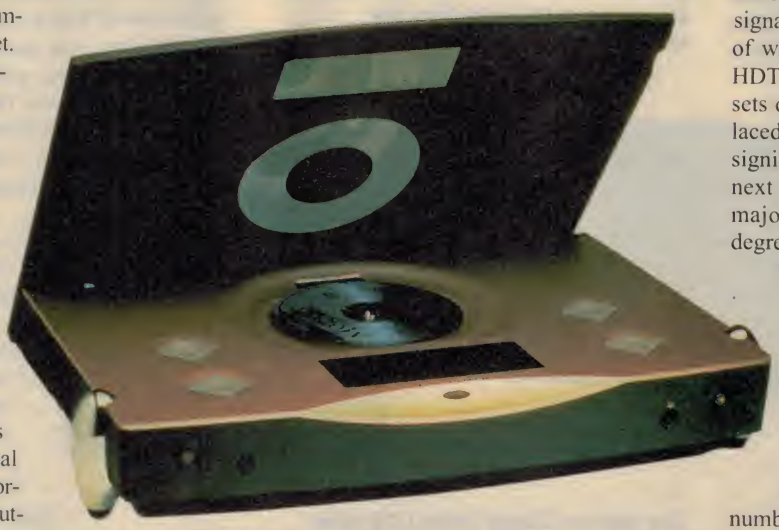
At first sight that concept seems to be a rather tall order. Notwithstanding, it is commonly viewed by the Committee members as the only way of ensuring a sensible progression from the archaic inhibitions and technical divergence of the 20th century's video and communication systems into the hoped-for consensus and common stream in the 21st century.

To many people's surprise the willing adoption and acceptance by these very competitive manufacturers of the 1394 Standard and its associated multi-media bus conveniently ensures that video, audio and computer graphics can in the future be integrated across the entire product spectrum. More intriguingly, in early-November 1998 — not long after the initiation of digital television broadcasts in the US — Panasonic Industrial Company (a division of Matsushita) and Philips' Semiconductor Division announced that they were releasing new 'all-format' digital television (DTV) tuner and decoder cards.

By purchasing a set of the cards, initially expected to retail at approximately US$1000, a buyer will be able to process the DTV signal using his or her existing PC to watch digital television — and more excitingly, the next mooted generation of digital information services. Not so surprisingly, the Panasonic PC-DTV tuner/decoder card was developed in close collaboration with Compaq Computers.

Both the Panasonic and Philips system emulations of this concept are based on two-board systems. These enable the current generation of computers to receive, decode and display the current DTV signals, as well as future high-definition television (HDTV) signals on either a computer or analog TV set. The system incorporates a tuner board that will receive signals in all of the proposed Advanced Television System Committee (ATSC) formats, as well as accepting the current NTSC analog signals. The associated video decoder board simply converts that processed signal into an appropriate format to suit the computer's specific video input requirements.

Above: Among the new HDTV receivers on display at CES was the Proscan PS61000, with an impressive rear-projection 61" screen. On the facing page is Sharp's 64-LHP4000, offering a 64" picture.



The stylish new Marantz MR-2020 tabletop music system, also on display at CES.

DTV formats

America's DTV is still facing battles over what is the most appropriate format that each TV station will adopt for its signals. The two main contenders are a 1080-line interlaced signal or a 720-line progressive format, both of which are now deemed to be legitimate HDTV displays. It appears that most of the sets on the market default to the 1080 interlaced video format. These issues have major significance for the both the current and the next generation of plasma displays, the majority of which lack the appropriate degree of resolution to optimally display those HTDV signals.

As I wandered around the CES, I discovered that there were more than a dozen manufacturers displaying 42" plasma displays of varying quality, with a few others — the most notable being Pioneer — exhibiting even larger 50" plasma displays. At this juncture, whilst a number of the other manufacturers are talking about releasing a 50" plasma display, only Pioneer have a production version to

show. It's very impressive, much more so than the 42" model we reviewed last year.

Supply problem

I spoke to quite a few retailers who are marketing plasma displays, and they seem to have no difficulty in selling this attractive new hardware, notwithstanding its high price. The problem that they faced, and about which they complained, was the paucity of supply. It seems that most plasma display manufacturers had underestimated the demand and their inventories couldn't keep up with orders.

The plasma displays that I saw provided visual quality ranging from fair to good (when displaying a standard NTSC television or DVD signal). The quality improved dramatically, to 'outstanding', when they incorporated or were fed by a line-doubler or similar signal processor and most particularly when handling an HDTV signal.

Whilst only a small segment of the population can afford those fabulous and expensive displays, a larger segment of the population have set their sights on the latest and next generation of lightweight portable high-luminosity, high-resolution projection TVs. Whilst their big and more expensive brothers, like the Runco series, utilise three tube conventional CRT projection modules, the latest generation of single or multiple LCD displays are most impressive.

By contrast, and although they're considerably less expensive, the American public is starting to shy away from the ubiquitous and visually-intrusive large screen rear projection TV sets. On almost every stand displaying conventional TV sets, the marketing hype claimed that their TV set now incorporates a 'super-flat screen'. Although I was unable to evaluate the objectivity and integrity of those claims, I noted that relatively few of those sets offered a performance comparable with that provided by Sony's latest generation of Wega flat-screen TVs.

RCA's new DVD player plays discs for the 'pay per play' Divx system, as well as standard DVD movie discs. Studios like Disney seem to prefer Divx, but consumers aren't so sure.

HDTV demo

The first thing I saw on entering the media and press room at CES was an extremely large high-definition digital television screen. I wasn't confused as to which country I was in, as the program displayed was a baseball game from some distant north-eastern city.

Whilst the American journalists were most impressed, I noted that the display, and more specifically its line resolution, was no more impressive than the demonstration hardware that two of the Japanese manufacturers had shown me in Tokyo more than 16 years ago.

The Vidikron Epoch D-600 LCD video projector, offering high light output and image quality.

The better — or should I say the best — of the plasma displays, projection TVs as well as the best of the rear projection and conventional TV sets being used in the demonstration suites, incorporated line-doubling or line-quadrupling to enhance their visual resolution.

The secret of line-doublers and related signal processors is their ability to mask the presence of the line raster, which become visually disturbing when dominated by a raster consisting of 480 vertical effective lines of signal in a typical NTSC transmission. Whilst that problem is less obvious on a PAL signal, the extra 100 lines do not obviate the visible limitations of such a system.

I spent considerable time comparing the visual quality of a large number of competing products to assess their quality firstly with, and thereafter without, line-doubling. Two of those evaluations involved assessments of the latest generation of Faroudja video processors, which provided either line-doubling or line-quadrupling.

Now the Faroudja video processors are not cheap. However once you've seen them (or better owned one), it's doubtful that you would willingly accept anything less. To put it bluntly, the difference between an ordinary video signal and one that has been visually enhanced by line-doubling, or line-quadrupling, is the difference between chalk and cheese.

The effective 480 lines of vertically scanned signal data in a conventional NTSC signal become visually degraded by the intrusiveness of the individual scanning lines, when the screen size approaches or exceeds approximately 35" (900mm). If you sit close to the display, as I did during many of the demonstrations, you are likely to find it just as disturbing as I did. Conversely, if you sit on the other side of the room, and more than 4m from the screen then you won't be disturbed — but you negate the dimensional advantage of the bigger screen.

The advantage of the line-doubler is that it converts the sparseness of that 480-line resolution into an effective 960-line signal, which puts its projected or displayed signal in the same class as the outstanding Japanese high-definition television sets that I viewed in Tokyo around 1988. When the standard 525-line NTSC signal is pre-processed by a line-quadrupler, the visual quality of the picture is marginally superior to that provided by a line-doubler, but of course its cost is also higher.

Now that I am familiar with the visual acuity provided by line-doublers and line-quadruplers, I must acknowledge that I will be most unwilling to purchase a new TV set, or more particularly, a plasma display or a new video projector that does not offer that functional advantage. If you haven't had the opportunity to evaluate what I'm talking about, I strongly recommend that when given the chance, you accept the offer to assess the quality and desirability of this new technology.

The Marantz SR-18 Home Theatre Receiver in its 'Gold' form. It offers inbuilt decoders for both Dolby Digital and DTS compressed digital surround sound audio.

Sharp displayed its VL-PD3U compact digital camcorder.

The Vidikron/Faroudja VP410 video line quadrupler: image quality doesn't come cheap. The suggested price is around US$24,000...

Hit movies

The big hit at the CES, and the displays that attracted my attention and literally sucked me — and many of the other attendees — into the various demonstration suites were the 'mega movie' demos supported by outstanding 5.1 channels of Dolby Digital audio.

Whilst some of the suites in which these systems were displayed were probably no larger than your living room, I noted with interest that relatively few of those suites displayed what I regard as being the normal acoustical attributes of a living room — as normally provided by appropriate areas of curtain, carpet or furnishings. Whilst many of the hifi demonstration suites sported modular acoustical wall panels or corner traps, by contrast few of the video or DVD-based suites applied comparable precautions to enhance the degree of reverberant control.

With few exceptions, (and of course there were *some* notable exceptions) the rooms lacked the acoustical attributes of the most basic family living room. It was soon evident that the video suite designers had made the appropriate speaker selection, and had judiciously placed those loudspeakers. As a result they were able to create a sense of reality that was disproportionate to either the cost, or the size, of the loudspeaker systems incorporated therein. It was equally apparent that you don't need to construct a large home cinema, nor possess a large living room, in order to achieve and optimise the outstanding sound quality inherent in a DVD system.

Because the majority of the individual display suites were fabricated using lightweight de-mountable structures, it wasn't particularly hard to find any of those rooms. As you approached them you were physiologically aware of the infrasonic energy that pervaded the space, and acted like a pheromone (i.e., compound secreted by insects in response to a stimulus such as sex, food etc, and used as a chemical means of communication). Once inside the suite, you were almost oblivious to the infrasonic energy, as you were aurally engulfed by the multi-dimensional spatial sound.

Home cinema was already a big hit in America when its available inputs were limited to laserdisc players with Dolby Pro-Logic encoded sound tracks. The last generation of laserdiscs incorporating AC-3 sound tracks, and the current generation of new DVD hardware (already backed by more than 2700 software titles in the shops) has irrevocably changed our perception as to what is acceptable sound quality. The American public has made clear — and the Australian public will soon — precisely what we want, as well as what we are now prepared to accept in such systems.

DVD, not laserdisc

It is apparent that the American public has decided that it is DVD that it wants, and that laserdiscs are *passé*. I discovered — much to my surprise — that you can no longer buy laserdiscs in any of the major retail outlets. It is obvious that the vast bulk of American households still lack a home cinema system, but it is equally obvious that a large proportion aspires to possess one.

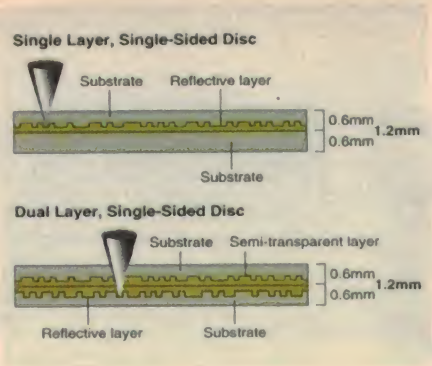
Each DVD player sold offers its new owner an immediate potential to create a low-performance home cinema system. If the new owner wishes to connect up the two-channel stereo output to an existing TV set, with or without the existing stereo music system, then he or she is already on the first rung of what will ultimately become a long and protracted ladder. It's my observation that the path taken by the majority of American and Australian purchasers will do precisely that, as the only additive cost involves the purchase of a DVD player.

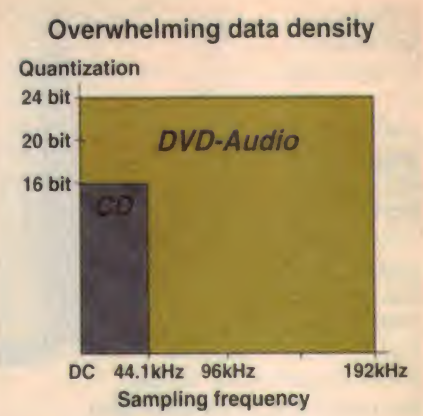
A somewhat smaller, and more affluent, sector of the population will go out and purchase, install or even construct a physically more advanced, and much more expensive system to capitalise on the six channels of multi-dimensional sound.

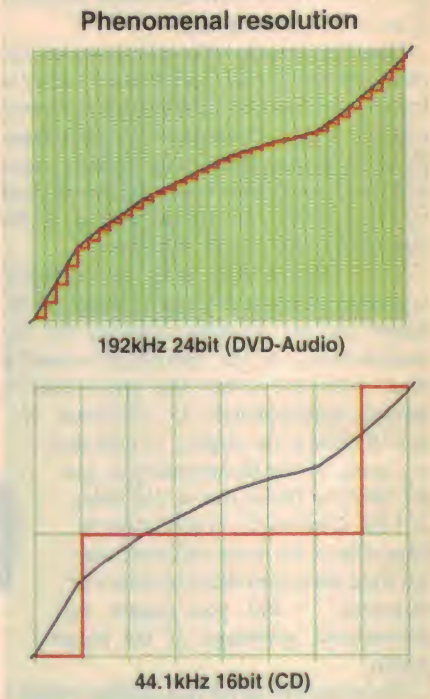
Whilst visiting Los Angeles prior to the CES, I was fortunate enough to have the opportunity to view, and more pointedly hear and assess, the subjective difference between an advanced sound system and an entry-level system. Obviously many, if not most, intending purchasers are offered similar opportunities. Once you've experienced the advantages and attributes of an advanced system, then there is an immediate and insatiable desire to further improve the quality of the picture and the quality of the sound.

Loudspeaker and hifi system manufacturers and installers have realised just how big and more pointedly, how lucrative that market is going to be. It currently provides an on-going workload for tens of thousands of Americans in the home installation market — which is booming.

Needless to say, many of those installers went to Las Vegas to discover what's new, and to capitalise on the training courses and tricks that were being displayed by manufacturers and some of the more innovative members of their peer group. There were literally hundreds of separate trade displays and demonstration home cinemas whose products were directed to, or focussed on the home cinema market. The products that they offered ranged from the sublime to the ridiculous, but that didn't matter.







Diagrams used by Panasonic in a brochure released at CES promoting the potential of DVD Audio. Above are the two basic kinds of disc layering; then (top right) a diagram showing the potential of DVD in terms of sampling frequency and bit depth; and finally (right) a comparison of the waveform resolution of 192kS/s 24-bit DVD Audio and traditional 44.1kS/s 16-bit CD audio.

It is apparent that the American public has decided that it is DVD that it wants, and that laserdiscs are passé.

DVD Audio

Late in the afternoon of my first day at the CES, I became aware of some new technology whose characteristics are most perplexing. The current generation of DVD players and discs have recently been supplemented by what is billed as being the 'next generation audio format': DVD Audio discs.

In December 1995, the 10 initial companies in the DVD consortium set up a study group (Working Group 4) to assess the most appropriate audio technologies and features to be adopted by the forthcoming DVD standard. Within two years the consortium opened its doors and the DVD forum membership grew to 40 companies comprising audio equipment manufacturers, software providers and related computer industry membership.

At the same time, an international steer-

Two new publications available from Electronics Australia

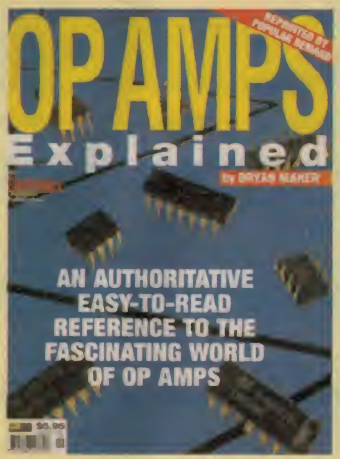
Basic Electronics

AT LAST there's a new and easy to read introduction to modern electronics for students and hobbyists. The author is well known technical writer Peter Phillips, a former technical college teacher who has produced many award-winning electronics textbooks and is also a regular contributor to Electronics Australia.

Peter's new book is written in an easy to read style, and includes not just theory but also a collection of simple construction projects, to give valuable 'hands-on' learning.

The book is designed to give you a good grounding in all of the basics of modern technology, with the 20 chapters covering everything from resistors to thyristors, batteries to power supplies and diodes to opto-electronics.

Op Amps Explained



LOOK INSIDE almost any piece of modern electronic equipment (even things that are normally 'digital'), and you are likely to find op-amps amplifying, shaping, clipping, detecting level changes or otherwise processing signals.

Without op-amps, we'd still be stuck in the electronic dark ages, and without a basic understanding of the way they work, and the way they're used, you probably won't get very far in today's world of electronics.

This book can be your guide and reference: it is authoritative, but at the same time very accessible - and it gets right down to the very concepts of op-amp operation to make them understandable as well.

We recommend it to everyone interested in analog electronics, operational amplifiers, and their applications, whether at a hobby level or as a serious University or College student. These are both on sale at your nearest newsagent, or you can order them directly from us here from our Reader Services Department for $6.95 each (includes P+P).

To order your copy of Basic Electronics or Op amps Explained, contact our Reader Services Department via email, or by mail or fax.

ing committee was created with a view to ensuring that there would be appropriate interest and music content provided or available. The critical feature of a conventional 12cm DVD format is its ability to achieve a 4.7GB (gigabyte) capacity on a single layer disc or 8.5GB capacity with a double layer single-sided disc. The DVD audio recording format employs linear pulse code modulation (LPCM).

The most significant claim for the new DVD audio format is its ability to dramatically improve the faithfulness of 'reproduction' of the original sound. If a 24-bit resolution is adopted, then (provided the analog to digital converter is linear) every minute nuance of the original audible signal can be reproduced.

The displays on the Panasonic stand replicated the size of the analog to digital steps with a 16-bit (CD) signal, and the 64 incremental steps that replace that single step. The displays also highlighted the overwhelming data density of the new format with its 192kHz upper limit sampling frequency, which they then compared to the modest 44.1kHz sampling frequency of a conventional CD.

To the uninitiated or ill-informed, such claims have considerable weight, as the statistics of the claim are most impressive. However the main pitfall in that argument, and that which may ultimately bring the whole concept to its knees, is the absence of a single standard on which each of the competing manufacturers may hang its hat.

Recent history has regrettably revealed how dangerous multiple standards can be. You only have to remember the Beta versus VHS debacle in the 1980s to understand the fundamental issues that concern me. If you don't recall the issue, go and have a talk with the senior salesperson at your local video shop.

The plethora of options being offered by the 'powerful new features' of the new DVD audio format are summarised in Table 1. On examination you will note reference to a range of bandwidths (the narrowest being 48kHz, the widest 192kHz), and signals with 16-bit, 20-bit and 24-bit resolution.

The new DVD audio format system's protagonists blandly claim that the audible quality provided by a 96kHz bandwidth and 24-bit resolution offers us an unparalleled standard of fidelity, which we will be able to audibly detect (and which by default, we need). There are a number of interrelated problems that these astute marketing personnel fail to address when extolling the virtues of this new system, of which the most critical:

1. We are not aware of any human adults with any significant (or relevant) hearing acuity above 20kHz;
2. There are no commercial microphones with associated pre-amplifiers which are capable of providing a 144dB dynamic range (i.e., the potential of 24-bit resolution);
3. There are no power amplifiers with a 144dB dynamic range;
4. There are no loudspeakers or headphones with 144dB dynamic range;
5. It is doubtful that there are any intelligent, or informed, audiophiles who would wish to be subjected to the (extremely dangerous) sound levels encompassed within an audible 144dB dynamic range;
6. It is equally doubtful that there are any musicians who would be either willing to play an instrument, or form part of an ensemble whose music encompasses a dynamic range of 144dB.

Whilst you may hold a different viewpoint, that hasn't stopped the second and third generation DVD player manufacturers from incorporating the 96kHz sampling frequency.

There were two new DVD audio format discs on sale at the CES, numerous examples of which were used to demonstrate the attributes of 96kHz sampling frequency and a claimed 20-bit resolution. Whilst the music was impressive, the real question that should be asked is whether they achieved a superior level of fidelity than that offered by a conventional and well-recorded 16-bit, 20kHz bandwidth CD with a 44.1kHz sampling frequency?

The answer has to be both yes and no! There can be no denying that a modest increase in bandwidth, from 20kHz to 25 or 30kHz, resolves many of the vexing problems associated with audible artefacts introduced by some of the low-pass filters circuits in some of the lesser quality CD players. This specific problem plagued previous generations of CD players, and is still a problem for quite a few of the current generation.

There can be no denying either that by increasing the inherent dynamic range of a CD from 16 bits to 18 or even 20 bits we similarly resolve many of the low-level noise and non-linearity problems associated with the present generation of CDs.

But in the end, the issue boils down to what is actually required or genuinely needed in the proposed or next generation of DVD audio discs and players. Only an informed marketplace can decide whether we really need a new CD format with wider frequency bandwidth and the associated improved dynamic range, which appears to be part of the equation whether we want it or not.

If you find this concept appealing, that's fine. Alternatively, you may share my fears that this is simply another manifestation of the old tale of the Emperor's new clothes.

The breadth of displays and new equipment exhibited at this year's CES encompassed a significantly wide range of interests amongst the attendees. Some of the displays were calculated to satisfy the most banal interest (including scantily-clad women, who managed to attract crowds that stretched out the front doors of the Sands Hotel Convention Hall!).

While many, if not most, of the exhibits could easily justify individual review articles in their own right, an examination of some of the more novel and exciting products will unfortunately have to wait until next month's article.

(To be continued.) ❖

Table 1: DVD Audio formats

Combination of audio contents	Configuration	Playback time per disc size			
		12cm disc		8cm disc	
		single layer	double layer	single layer	double layer
2-channel only	48kHz, 24 bits, 2 channels	258 min.	469 min.	80 min.	146 min.
2-channel only	192kHz, 24 bits, 2 channels	64 min.	117 min.	20 min.	36 min.
Multiple channel only	96kHz, 16 bits, 6 channels	64 min.	117 min.	20 min.	36 min.
Multiple channel only	96kHz, 20 bits, 5 channels	61 min.	112 min.	19 min.	34 min.
2-channel & multiple-channel (same contents)	48kHz, 24 bits, 2 channels +96kHz, 24bits, 3 channels & 48kHz, 24bits, 2 channel	43 min. each	78 min. each	13 min. each	24 min. each

NOTES & ERRATA

Computer Clinic (January 1999): A hyphen was omitted from the URL for the CD-ROM God website, but it turned out that they had moved from their original address anyway... The latest address is http://www.welcome.to/cdromgod, which shouldn't change in the foreseeable future.
Screecher Car Alarm (January 1999): An error in the schematic diagram shows R17 as 5.6k and R19 as 10k. The correct values are as shown in the parts list and overlay diagram, where R17 = 2.2k and R19 = 5.6k.
Webwatch (January 1999): Due to our columnist being abducted by aliens, he forgot to disclose the URL for Craig Hart's Home Page. The URL for this site is: **http://home.hyperlink.net.au/~chart/index.htm**
EPROM Programmer (September/October 1993): EA reader Craig Hart has come up with a number of modifications that allow the programmer to support 27512, 27010 and 27020 EPROMS. While the mods are a bit too lengthy to print here, you can download from our website EPROMODS.TXT which covers the modifications needed for the programer to handle these larger EPROMS.
Recording Front End for PCs (September 1998): It would appear that the input resistance of the line inputs on some sound cards is much lower than the typical figure of 40k ohms, for which the RFE was designed. We have found one example measuring 11k (in parallel with 2.2nF).
To prevent the low input resistance of such cards from causing bass attenuation, the values of output coupling capacitors C33 and C34 could be increased, from 0.47uF to 2.2uF.
However if your sound card has sufficient input sensitivity to allow a reduction in effective RFE gain, another approach would be to increase the values of output series resistors R51 and R52, to increase the effective load resistance presented to the output amplifiers of U4 — and hence minimise distortion as well as restoring bass response.
If you increase the value of R51-52, they should also be shunted with small capacitors to compensate the resulting divider and prevent treble attenuation. For example if you have a sound card with inputs of say 20k//2.2nF, you could increase R51-52 to 20k and shunt them with 2.2nF capacitors. This will result in a 6dB drop, but maintain a flat response.
Universal IR Controller for a PC (Circuit & Design Ideas, September 1998): A number of readers have pointed out that the circuit as shown won't work, as the open collector outputs of the 7405 can't source current, and can only act as current sinks. To fix the problem, the end of R5 should be disconnected from ground and attached to the outputs of the inverters. The anode of D1 should then be isolated from the inverters, and instead taken to +5V.
The other alternative is to simply swap the 7405 with the 7404 hex inverter, which can source the required current.
Super Ear (May 1998): The component identifiers C9 and C10 have been swapped in the parts list. C9 should be a 0.1uF monolithic bypass and C10 should be a 100uF electrolytic. Both the circuit diagram and component overlay are correct.
Cable Break Finder (February 1998): LED1 is shown reversed on the component overlay diagram. Its cathode should connect to pin 6 of IC1, with its anode going to the positive rail. The circuit diagram is correct. ❖

Diamond's Rio Personal MP3 Player

The Rio is new, cool, different, relevant, exiting, useful and one of the most interesting products that I have had the pleasure of reviewing. Fill it up with music from your own CDs, or download some off the Internet, and you have the ultimate personal stereo — no discs or tapes to carry, no moving parts, no skipping or bad reception, and it runs off a single penlight battery to boot.

by Graham Cattley

DIAMOND MULTIMEDIA's Rio PMP300 is perhaps one of the most revolutionary and innovative consumer products to appear in recent years, and one that will change the way that you think about recorded music. Its appearance on the market has been cause for a great deal of concern in the music distribution industry, and even resulted in an injunction against Diamond by the RIAA (Recording Industry Association of America) in an effort to prevent Diamond from selling the device.

So, what exactly *is* the Rio? And why all the fuss?

Well, to start with, the Rio PMP300 is a small handheld MP3 player that can store over an hour of high quality music that is digitally compressed using MP3 (MPEG-1, Layer 3) technology. MP3 files can be created, converted, recorded and stored on your PC, and then downloaded into the Rio. Around the same size and shape a small Walkman, the Rio contains 32MB of Flash RAM to store the files, has no moving parts and runs for around 12 hours off a single AA battery.

All the fuss is due simply to fact that you can easily create your own MP3 files from a CD or other audio source. With MP3 files running at around a megabyte a minute, it is reasonably easy to pass files onto to friends — and thus bypass the entire music recording, marketing, distribution and sales industries. Of course the original artists miss out too, but for some strange reason you don't seem to hear much about that side of the matter.

What's in the box

As soon as we heard that the courts had revoked the RIAA's injunction, we lost no time in getting one in to review. At first glance it looks much like any other personal stereo player, with a large central four-way button offering the usual forward, reverse, play/pause and stop functions. It is only after a minute or so that you realise that there isn't any loading mechanism for a tape or disk — just a miniature 15-way connector to hook the Rio up to your PC, and a 35mm-long slot for a 32MB flashcard upgrade.

The Rio comes with a one-metre connecting cable, a parallel port passthrough adapter, a pair of in-ear 'Bolas' style earphones, and even a battery. There's also a comprehensive 24-page users guide, and two CDs — one containing the Rio Manager, recording and database software, and the other containing around 75 sample MP3 files ready to download into the Rio.

Software

The Rio Manager is the only means of getting your MP3 file into the Rio, and while the program took a little experimenting with

its slightly non-standard interface, it all made sense in the end. During the installation procedure, you also get the option to install MusicMatch Jukebox, which despite its name is a reasonably competent piece of software. It allows you to record tracks off a CD and convert them to MP3 format, compile playlists of songs to be uploaded to the Rio, play MP3 files on the PC and add each title to a database so that you can find songs listed under Title, Artist, Style, etc.

Setting up was simply a case of installing the Rio Manager (which was pretty painless) and connecting the Rio up to the parallel port via the supplied adapter and cable. I didn't bother with reading the instructions, and with a few minutes clicking around, I was able to download a couple of the sample songs into the Rio's Flash RAM, and was soon bopping around the office...

The download speed is around 100KB per second, so filling the Rio with 32MB of MP3 files takes around five to six minutes. This equates to around 35 minutes of music at the standard average bit rate of 128kb/s, but you have the option when recording your own MP3s of selecting either 64kb/s (giving you over an hour at low quality), 32kb/s (over two hours at 'telephone' quality), or 16kb/s (over four hours at dreadful quality). You can of course elect to go the other way, and record at the highest rate of 256kb/s (near CD quality), but this only gives you about 17 minutes playing time. The standard 128kb/s is more than adequate for normal headphone listening, and you'll find that 99% of the MP3 files that you come across from the Net are recorded at this rate.

The Rio's Flash RAM can be increased by inserting either a 16 or 32MB 3.3V Flash RAM card, and this could give you over an hour at 128kb/s. This would allow you to dump the contents of a whole CD into the player, which I think is quite impressive...

As I mentioned before, the Rio's central button lets you step through the tracks loaded into RAM, as well as fast-forward and rewind through the current track, pause, play and stop. As well, there are the usual CD-player style functions including random play and track repeat. Along the top edge of the Rio are a row of three buttons: 'Intro', which plays the first few seconds of each track in turn, 'EQ', which cycles through four different equalisation settings (Normal, Classic, Jazz and Rock), and finally one marked 'Menu'.

Pressing this last button brings up a display telling you the total RAM in the unit, the amount of external RAM (i.e. the size of the Flash RAM card, if installed), the number of megabytes free in both the player and the card, and the firmware version number. The fact that both the internal RAM and external RAM are listed separately is of slight concern, as it highlights the fact that the Rio treats the two as two distinctly different areas. For example, songs stored in the Flash RAM card can only be played after those stored in the Rio's own internal RAM.

A further slight niggle is that the display doesn't give you the name of the track being played. The information is in there, and so it would be nice to see it rather that having to remember what track 12 was called.

One last point to raise is that the Rio is quite a thirsty beast — when running it draws over 200mA from its single penlight battery. (The Rio does shut itself down after 15 seconds idle time, however.) During the week that I had the Rio, I'd say that I had played it around three hours or so, by which time the battery indicator was reading low. To make matters (slightly) worse, the Rio draws 1.1mA when turned off — to power its CPU perhaps? I don't know, but I wouldn't mind betting it is just so that it can sit there monitoring the On button...

Inside the Rio are five 8MB non-volatile Flash RAM chips, four of which are used to store the MP3 files. The other one is presumably used to hold the firmware, which would indicate that Flash RAM prices have fallen to a point where they can compete with the more traditional ROMs.

The Rio is one of the first personal MP3 players to appear on the market, and I have a strong feeling that it won't be the last. MP3 is certainly looking to be the music format of the future, and I wouldn't be surprised to see some significant advances in the Rio over the next 12 months. If they were to halve the cost, double the RAM, and display track information, I think that they would wipe out the personal tape and CD player market overnight. Not bad for a first of its kind product, don't you think?

If you are after more information on the Rio, check out Diamond Multimedia's website (**http://www.diamondmm.com**) where you'll find all the technical specs. Another site that may be of interest is **http://www.mp3.com**, which covers all the latest news and views on MP3, and offers a number of MP3 files to download as well. ❖

Diamond Multimedia's Rio PMP300

A personal MP3 player with 32MB RAM, storing 30-60 minutes of pre-recorded music.

Good points: Knocks personal tape and CD players into a cocked hat.

Bad points: High current drain; display of track info would be nice.

RRP: $499.

Available: Chips and Bits Australia, 14-16 Boundary Street, South Melbourne 3205.

The trouble with MP3

"MP3 files? They're illegal, aren't they?"

So asked a colleague of mine when he first heard about the Rio, and it seems to reflect the general level of public awareness of MP3s.

Never before has a computer file format caused so much fear, anxiety and outright panic. Ever since the Motion Picture Experts Group came out with the MPEG-1 Layer 3 audio compression format (known as MP3), the world's record companies have been running around in ever-decreasing circles. An understandable first reaction perhaps, but they're going to have to come to terms with it because MP3 just isn't going to go away.

The reason that MP3 has caused such a stir, is that MP3 encoding can compress an audio recording into a file a tenth the size of a standard WAV file, while still maintaining quite a respectable sound quality (the JPEG of the audio world, if you like). This in itself is harmless enough, but the record companies are worried because with these significantly smaller file sizes (3-4MB for your average three-minute pop song), people are apt to send each other music over the Internet and via email. This of course chops the distributors out of the equation, cutting back on their profits.

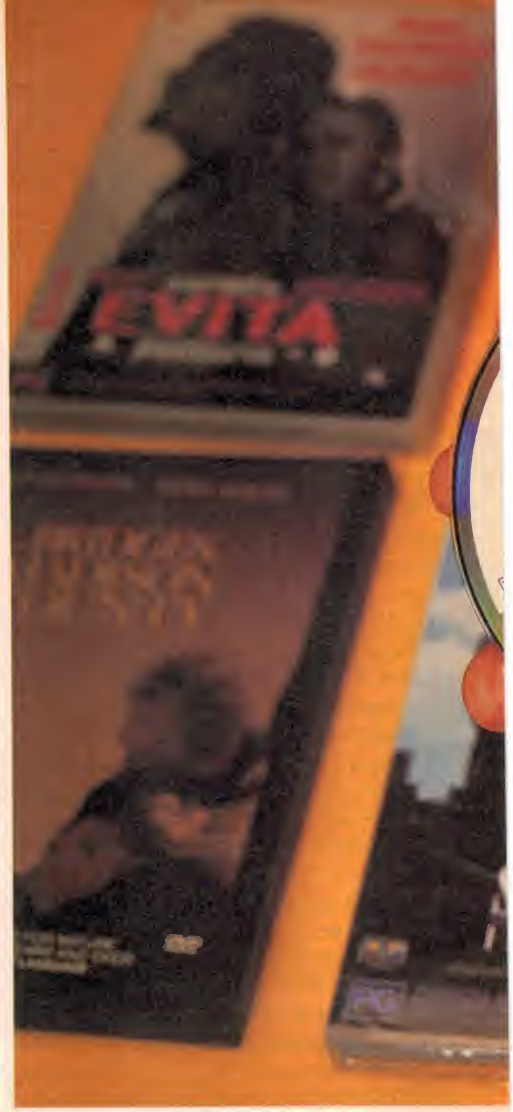
There's actually nothing illegal about MP3 files in themselves. The problem comes when people disregard copyright — and in this light they are no worse than WAV files, Real Audio, GIFs, JPGs or even text files.

Because MP3 encoding software is readily available off the Internet, and even the latest version of Microsoft's Media Player can *play* MP3s, there's no stopping people from recording their own copies of their favorite songs and passing them on to friends. I think that the record companies will have to wake up to the fact that the days of people paying $30 or more for the latest album are almost certainly over. If they want to stay in the game, they will have to release a good proportion of their music in MP3 format, perhaps on a pay-per-track basis.

This is already happening in Asia, where you can take your personal MP3 player to a music vending machine, insert a couple of coins and download the songs you want. Because the MP3 file can't be extracted from the player, the music distributors can be assured that the file isn't going to be re-distributed, and will only really be heard by the owner of the player. ❖

DVD:

What's All the Fuss About?



Just what are these DVDs that have started to appear in the video stores and libraries, looking very much like a CD, but containing a whole movie — complete with surround sound? Have they been hyped up, or are they really so much better than VHS videotapes? And what's all this talk about regional coding? Here's a rundown on DVD basics, and hopefully the answers to most of your questions.

by Jim Rowe

YOU'VE PROBABLY noticed them starting to appear in your local video store or library, usually in a small display rack in the corner. It's fairly obvious that they contain a movie, but in a much slimmer case than a VHS tape. And if you've seen inside, you'll know that there's no tape — just an innocent-looking disc 120mm in diameter, almost identical in appearance to a familiar music CD or CD-ROM.

Meet the new DVD video disc, key to a new era of enhanced home video and audio enjoyment. The acronym 'DVD' stands for Digital Versatile Disc, and the technology it embodies has the potential for a quantum leap in our ability to store high quality video, audio and data in compact and more convenient form.

If you've also seen the players for these discs, you'll know that they look very similar to a CD player. The main difference is that there are extra sockets on the back, including one or more for video output. Just about all DVD players will play standard CD audio discs as well — and often with better fidelity than many high-end CD players.

Actually, although we may only see DVD *video* discs much for a while, it's likely that before long there will be both 'super hifi' audio DVDs and DVD-ROM discs for your computer, as well. And after that, there will probably be recordable and/or rewriteable versions of all three types of DVD. In fact it's a fair bet that DVDs are likely to replace not only audio CDs, video CDs and CD-ROMs as we know them, but video and audio tapes as well, in the long run (although that may take quite a few years).

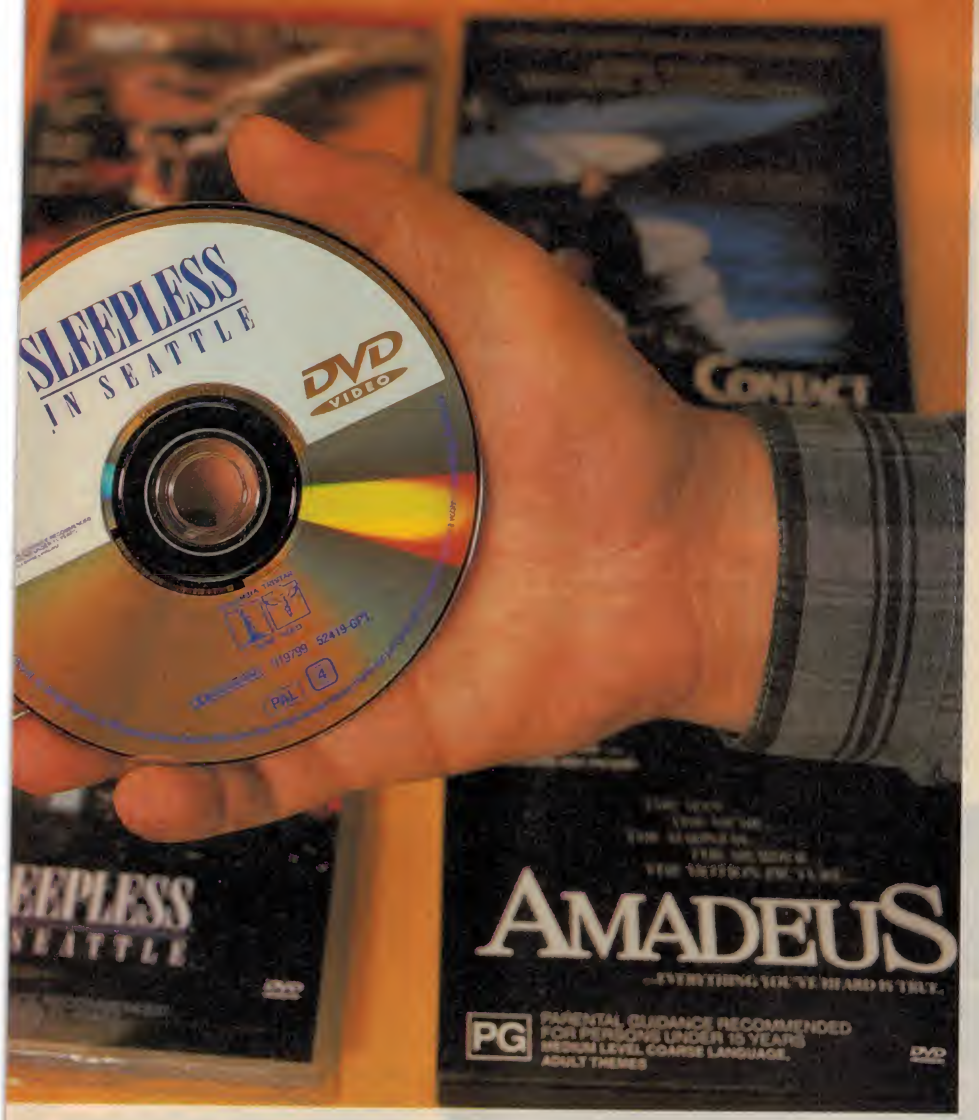
But let's start at the beginning. From the name, it's clear that part of the reason why DVDs are capable of so much is today's all embracing *digital* technology: like a CD, everything on a DVD is in the form of digital information. Bits and bytes, 1's and 0's, vast strings of binary numbers. But the DVD is essentially a 'next generation' digital medium, with important enhancements over CDs as we've come to know them.

The first concept to grasp is that DVDs use improved optical disc recording technology, which packs a lot more information into those tiny laser-read pits on the disc tracks. In fact the basic recording density is about *seven* times as great; the size of the pits has been reduced by a factor of just over two (0.4 micrometres, vs 0.83um), while the track spacing or 'pitch' has also been reduced by a factor of over 2.1 (0.74um, vs 1.6um). This means that for a start, the new technology can store up to 4.7GB (*gigabytes* — i.e., 4700 megabytes) of data on a disc surface, compared with the 650MB or so of a standard CD.

Then there's *dual-layer* technology, which allows a DVD to have two recording layers on the same side of the disc. One is right on the 'back' of the plastic disc, as with a CD, while the other is half-way through. The laser pickup in the DVD player is able to focus on either one layer or the other, and play them one after the other to deliver almost twice the basic information capacity — about 8.5GB.

(Usually dual-layer discs play the first layer in one direction — from the centre outward — and the second layer in the opposite direction, to give as brief an interruption to playback as possible. As a result, they're often called 'RSDL' discs, standing for 'reverse spiral dual layer'.)

Another option is that DVDs can also be made double sided. This means that a disc has to be physically 'turned over' to play the second side, rather like a laserdisc or an old LP record. A small proportion of the movies on DVD use this 'flipper' format, which pro-



vides about 9.4GB of storage.

The DVD specification even allows for dual-layer, double sided discs — which would provide about 17GB of storage. However to the best of my knowledge, there are no such discs as yet.

By the way, it isn't just the smaller pits, closer track spacing and dual layering that gives DVD its much higher storage density compared with conventional CDs; it uses other technology enhancements as well. For example it uses a slightly wider track area, a more efficient system of modulating the information into the track pits, more efficient error correction and also more efficient sector addressing. The players also use a laser emitting in the visible red part of the spectrum (about 650nm wavelength), instead of infra-red (780nm).

Not enough

All up, though, even a single sided, single layer DVD provides about seven times the storage capacity of a CD. Which is quite an improvement, although not in itself nearly enough to allow storing a complete movie on the disc. In order to understand how *that* has been achieved, we need to look at the other main technology DVD incorporates: digital compression.

First, some digital sampling basics. As you're probably aware, conventional audio CDs record the signals as a continuous stream of digital samples — 44,100 of them every second for each of the two stereo channels. Each sample is essentially a binary number representing a direct 'snapshot' of the signal's voltage at the instant concerned, and each new sample simply describes again the voltage on that channel 22.67 microseconds later than the previous sample. This type of digital recording is described as *linear pulse code modulation* or 'LPCM'.

To store the amount of data required for high quality (16 bits per sample) LPCM stereo audio recording, an audio CD must store 176,400 bytes of data for every second of recording. That equates to about 10.3MB (megabytes) of data per minute, and is why an audio CD can store only about 73 minutes of audio.

By the way, the reason why CDs must take 44,100 audio samples per second is that in order to allow accurate reconstruction of the original analog signal at the replay end, digital recording must take its samples at a rate of at least *double* that of the highest frequency component in the signal (Nyquist's sampling theorem).

So in order to reproduce audio signal components as high as 20kHz, for 'hifi' sound, CDs use a sampling rate of a little over twice this figure: 44.1kHz. At this sampling rate the stream of data bits (1s and 0s) coming from an audio CD during playback is at around 1.38Mb/s (megabits per second), by the way.

Now if we were to try and use LPCM to record video information, the sampling rate we'd need to use would have to be around 13.5MS/s (millions of samples per second), to cope with a video bandwidth of say 5MHz. And although video signals are usually only 'mono' (i.e., single channel) and you could probably achieve reasonable video quality using 8-bit samples instead of the 16-bit samples needed for audio, even this would call for the ability to store 13.2MB of data for every *second* of video, with a bit rate of 108Mb/s. So even a DVD, with its ability to store 4.7GB of data per layer, would only be able to store about six minutes of video per layer!

In fact, it turns out that to be able to achieve good 'studio quality' video, you really need to sample at a data rate of around 125Mb/s — where you'd only manage to squeeze about five minutes of video onto the 4.7GB of a DVD layer.

So here's where *digital compression* comes in, as the only way of fitting a full movie onto a DVD. You simply can't do it with the LPCM 'linear sampling' system; that 167Mb/s data stream must be somehow boiled down, so that the 4.7GB space that would normally hold only five minutes of video will somehow store over two hours. We need to compress the video by a factor of around 35 times.

Without digital compression, even a DVD, with its ability to store 4.7GB of data per layer, only be able to store about six minutes of video per layer...

Digital compression

But how does digital compression actually work? We can't go into all of the fine details here, because they're pretty complex; however I'll try to give you at least a basic idea what's involved.

Essentially, compression relies on reducing the information *redundancy*, or duplication in the video signal. And there's two basic types of redundancy: temporal (time related) and spacial (space-related).

In a traditional analog video signal, there's actually a huge amount of redundancy, because every video field is essentially a complete picture of the scene we're viewing — and each field is replaced by another picture taken 1/50th of a second later (in the PAL system). Most of the time, there's very little difference between the video information in one field and that in the next, except when there's a scene change, or an object travelling very rapidly. So most of the time, we're sending the same image information over and over again; in other words there's a high degree of *temporal redundancy*.

Even within each field image, there's often still a lot of redundancy as the image is 'scanned'. For example if the top third of the image is blue sky, as it might well be in an outdoor scene, much of the time needed to send each field will be spent sending the information describing a succession of near-identical light blue picture dots (pixels). The same will apply whenever the picture contains significant areas of the same colour and brightness level. This means that most individual fields have a high degree of *spacial redundancy*.

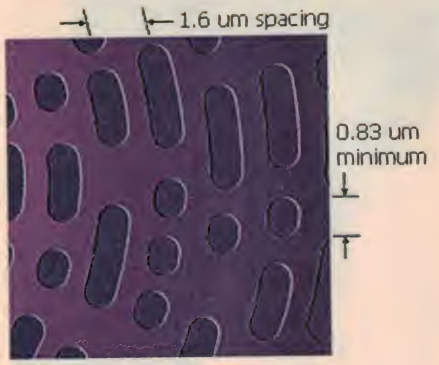
The basic idea of video compression is to reduce the amount of information which needs to be stored or sent, in order to recreate the images, by removing a lot of this redundancy. To reduce the temporal redundancy, this is done by mainly sending only the information describing the *differences* between successive fields, rather than sending all of the image information over and over again.

To reduce the spacial redundancy, a variety of techniques are used to send the image description more efficiently. For example one technique is 'run-length encoding' (RLE), where the information to recreate a chunk of sky with say 4000 light blue pixels would be sent as the digital equivalent of 'next 4000 pixels all light blue' — instead of sending 4000 separate samples, all of which are the same code for a light blue.

Another technique is 'discrete cosine transformation' (DCT), which is a way of boiling down the important information in each 8 x 8 block of image pixels into an equivalent set of DC and higher frequency modulation components, which can be sent more efficiently.

The fine details of how these techniques work are quite complex, and really only of much interest to engineers. However the important point to grasp here is that virtually none of the techniques were really available in the days of analog technology; they've only become practical with today's advanced digital technology. That's because achieving digital compression and/or reconstruction of video signals in 'real time' (i.e., while you're watching) requires a huge amount of signal processing. We're talking about high speed, dedicated digital computers — some pretty fancy 'number crunching'.

So it's thanks to modern digital technology that digital compression of video signals has become possible, and that's how a complete movie lasting over two hours (up to at least 133 minutes) can be stored on a DVD disc layer storing 4.7GB — with multi-channel surround sound thrown in as well.



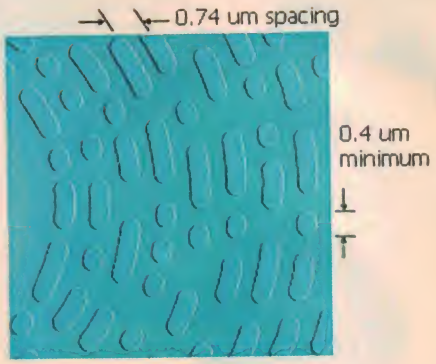
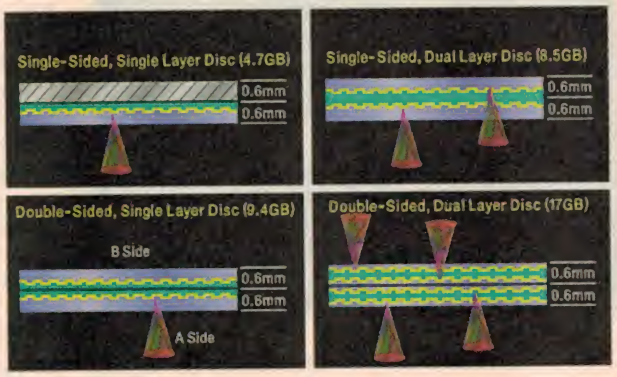


Fig.1 (above): Part of the reason why a DVD (right) can store more data than a CD is its smaller pit size and closer track pitch. (Courtesy Toshiba)
Fig.2 (below): There are four possible DVD configurations, from single sided, single layer to double sided, dual layer. (Courtesy Sony)



Very high quality

We'll get to the sound side in a moment, but first a few basic facts and figures about the video on a DVD.

The digital video on a DVD is of a very high quality indeed — roughly double that from VHS tape, and significantly better than laserdisc. In fact it's very close to broadcast studio quality. With the PAL-format discs sold in Australia and NZ, the basic image resolution is 720 x 576 pixels, with an effective luminance resolution of 12 bits per pixel and a colour depth of 24 bits. In terms of traditional video horizontal resolution, they deliver about 500 lines of resolution compared with about 230 for VHS and 425 for laserdisc.

The 'raw' bit rate for this video (i.e., before compression) is between 119.4 and 124.4MB/s, depending on the source. MPEG-2 digital compression technology is used to squeeze this down to a maximum bit rate of 9.8Mb/s, with an *average* bit rate of only 3.5Mb/s. This corresponds to an average compression of about 35 times, as you can see — an impressive achievement.

Incidentally because the video decoded in a DVD player is already in digital RGB component form, it's not very difficult for the player manufacturer to provide either component video and/or S-video outputs as well as traditional composite video. This tends to make it easier for the user to achieve the best possible pictures when viewing from a DVD.

Along with the main video bitstream, a DVD can also have 'sub picture' streams, with information such as subtitles and closed

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captions for the hearing impaired, still pictures and menu screens, etc. The average bit rate for this 'extra' video material is typically about 10kb/s.

Wide screen format

A final point about the visual side of DVD is that most movies on DVD have the video in a 'wide screen' format, with roughly the same aspect ratio as the original cinema version. This means that if you have a wide screen TV or video projector, you can take full advantage of its features. However most DVD players are able to reformat the video into 'letterbox' format, for display on a standard aspect ratio TV.

This means that you still see all of the widescreen image, but there are 'black bars' displayed above and below the image — effectively wasting some of the screen. The height of the bars varies according to the movie's original aspect ratio, and with those that were filmed in 2.35:1 ratio (Panavision, etc.), the live image only occupies a little more than the centre third of a TV screen.

Note, though, that this 'letterboxing' doesn't happen with DVDs of material originally shot for TV, though, or with most old movies, or with movies that have been processed into 4:3 format using the 'pan and scan' technique.

Multi-channel sound

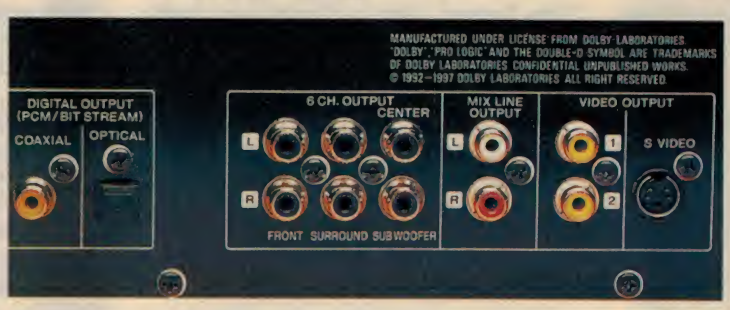
So much for the video, then; but what about the audio? Here DVD technology again delivers a pretty impressive punch.

Basically the DVD standard allows for up to eight digital audio channels or 'data streams', quite apart from the video — although the larger the number of these channels that are provided on a DVD, the shorter the running time per layer. Typical DVD movie discs have from one to five audio channels, offering say the main movie audio in a choice of say two or three languages, plus in some cases commentary track(s) by the director, stars or special effects people.

Each of these audio channels can contain digital audio in one of five formats, including LPCM (uncompressed). The compressed formats are Dolby Digital (DD, formerly called AC-3), MPEG audio, Digital Theater Sound (DTS) and Sony Dynamic Digital Sound (SDDS). The main protocol requirement is that NTSC-format discs for the US market should have at least one channel with either LPCM or DD, while PAL-format discs should have at least one channel with LPCM, MPEG or DD audio.

As yet, the vast majority of movie DVDs seem to have at least one DD track, sometimes two or three in different languages. A few discs also provide DTS tracks, while very few seem to offer LPCM, MPEG or SDDS tracks. Because LPCM tracks require a much greater bit rate than any of the compressed formats, it wouldn't be easy to provide compressed sound channels along with them. On the other hand it's feasible to provide a number of compressed audio formats on a single disc, although this isn't often done.

From the front, most DVD players look very similar to a CD player. The major differences are at the back, where there are video outputs — and possibly Dolby Digital surround sound outputs as well, as with this Kenwood DVF-5010M.



Basically, most of the compressed digital audio formats squeeze a number of audio channels into a bitstream with an average rate of 384kb/s — a little over a tenth of the average video bit rate. (So depending on the number of digital audio channels on a DVD, its total average bit rate can vary between about 3.9 and 5.0Mb/s.)

Into one of these digital audio channels, the Dolby Digital compression system can squeeze from one to five full-range separate audio channels — plus a restricted range 'low frequency effects' (LFE) or sub-woofer channel (the '0.1' track). Many of the movie DVDs have at least one track of full 5.1-channel surround sound, and possibly more for the different language options. Sometimes as an alternative there's a two-channel Dolby Surround track, capable or being either played in stereo or decoded into 'analog surround' using a separate Dolby Pro Logic or similar decoder.

Similarly the MPEG-2 audio compression system can squeeze from one to 7.1 audio channels into one of the DVD audio tracks, while the DTS system can fit up to 5.1 channels but using a lower compression factor than DD. Sony's SDDS system can provide up to 7.1 channels, using ATRAC compression.

Virtually all of these digital audio compression systems are 'lossy', in the sense that they permanently remove some of the original sound information. They're based on psychoacoustic principles, which rely on the fact that when multiple sounds are present our ears tend to hear mainly the loudest sounds. This means that quite a bit of the 'background' material can actually *be* removed, without its absence being noticed. This reduces the amount of sound information to be sent, and achieves a significant amount of compression. It's basically the same principle that is used in Mini Discs, DCC and the MP3 audio files available on the Internet.

By the way, virtually all DVD video players incorporate a Dolby Digital decoder and/or an MPEG audio decoder. However in many cases they only provide a 'mixed down' two-channel analog audio output — which gives effectively Dolby Surround signals, capable of being played as stereo or decoded via a Dolby Pro Logic or similar decoder.

A few players, like the Kenwood DVF-5010M and Panasonic DVD-A350A, incorporate a full DD decoder capable of delivering all 5.1 channels of surround sound analog audio, ready to drive the appropriate number of amplifier channels. However most of the other current players just provide a digital bitstream audio (either electrical or optical) output, to allow separate DD/MPEG/DTS/SDDS decoding.

Of course the player and/or decoder can only decode one of the audio tracks present on the DVD you're playing, and the options here depend on the producer of the movie. It's also true that some DVD players are not able to recognise DTS or SDDS tracks, and don't even make them available from their bitstream output for external decoding.

The bottom line, though, is that with most movies on DVD you have the option of enjoying full 5.1-channel discrete surround sound using a DD or other compressed digital decoder, or 4.1-channel 'analog surround' sound via a Pro Logic or similar decoder, or at the very least two-channel stereo via your hifi system.

Copy protection

Largely because of the very high video and sound quality provided by DVDs, and their use of digital recording, the movie producers have been very anxious about the possibility of copying. As a result, most DVDs incorporate a number of different levels of copy protection technology — including the Macrovision system used in many commercial videotapes.

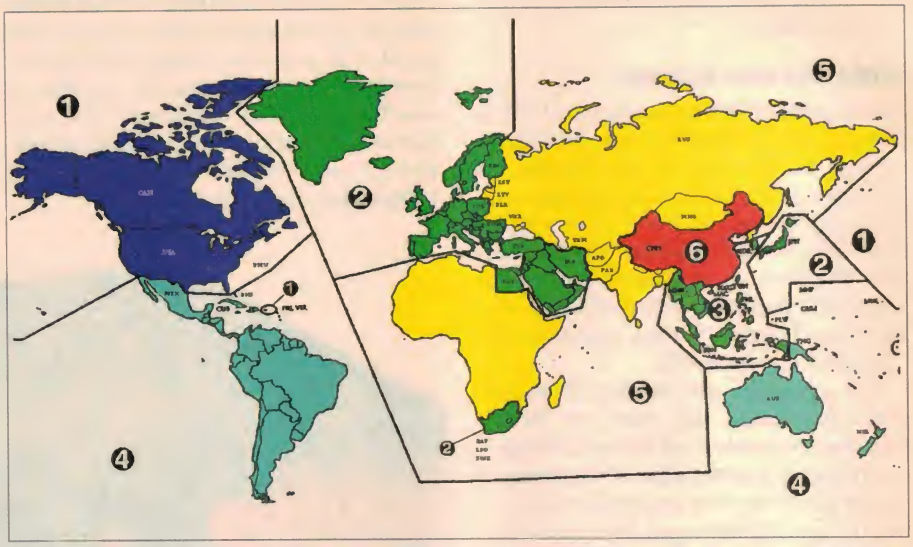
Broadly speaking, this means you can forget the idea of making your own VHS copies of movies from DVD. Why you'd want to is another question, of course; the copy would be so inferior in quality, anyway!

In fact the copy protection on DVDs tends to be so aggressive that you generally can't even feed the video from a DVD player through a VCR simply to get it into your TV set. It can also cause problems with high end large-screen sets incorporating line doubling.

On the whole, though, if you simply want to watch a DVD movie on your TV set, hooking the player's video output up to one of the direct video inputs on the set will deliver excellent pictures.

DVD regions

Finally, let's look briefly at the thorny subject of DVD regions. As you've probably heard, the movie producers insisted that the DVD system incorporate a regional coding system so that they could control the release of movies on DVD in the various regions of the world, basically to maximise their returns.



A world map showing the six different 'regions' for which DVD discs are coded. This is designed to allow the movie studios to control DVD release in each market. (Courtesy Panasonic)

The idea is that the world is divided into six regions or 'locales', with region 1 including Canada, the USA and US possessions; region 2 covering Europe, Japan, South Africa and the Middle East; region 3 covering South-East and East Asia (including Hong Kong); region 4 covering Australia, New Zealand, Mexico, Central and South America, the Pacific Islands and the Caribbean; region 5 including the Indian subcontinent, the former USSR, Africa, North Korea and Mongolia; and region 6 — essentially China.

All DVD video discs are encoded according to the region in which the producer permits them to be played, and the DVD players sold in each region are fitted with firmware which decides whether it will play any particular disc according to its code. If the disc is encoded as playable in that region, the player will play it; otherwise it will refuse to do so.

(By the way discs can actually be coded so they're playable in all regions — for old movies, etc — but so far very few if any seem to have been released with this coding.)

That's the way the movie producers planned it all to work, anyway. The only problem is that for many people in regions other than region 1, the coding system has resulted in a very slow release of movie titles for their area. In fact although over 2500 titles had been released in region 1, at last count, most other regions had seen less than a tenth of that figure.

Needless to say this has generated a lot of consumer frustration, and as a result many consumers are now refusing to buy DVD players unless they're capable of playing discs coded for other regions (especially region 1). Firms selling players have therefore been motivated to provide players which have been converted to be 'code free' or 'multi zone', and quite a few DVD disc retailers have been motivated to import directly region 1 discs, to meet consumer demand.

(By the way region 1 discs are made for the NTSC market, so even if you have a DVD player which will play them, you still need a multi-format TV set capable of displaying NTSC as well as PAL. Many of the newer sets do this, of course.)

This 'DVD grey market' has grown dramatically in countries like Australia, and you'll find many vendors offering both region 1 movie discs and players capable of playing them (as well as playing discs from our own region 4). So the whole DVD market is developing into a 'battle of wills', between Hollywood producers seeking to maximise their profits, and consumers seeking to maximise their choices when it comes to high quality home movie viewing. It will be interesting to see what happens. ❖

DVD resources on the Web

If you'd like to know more about DVD technology, here are the URLs for some of the more helpful Web resources:

http://www.videodiscovery.com/vdyweb/dvd/dvdfaq.html
http://www.c-cube.com.technology/dvd.html
http://www.mpeg.org/MPEG/DVD/
http://www.dolby.com/dvd/
http://www.homecinemachoice.com/
http://www.thx.com/consumer_products/home_faq.html
http://www.dtsonline.com/consumer/whitepaper.html
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Cat. 2315 **Bi-directional 2 Port** $61
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Reader Info No. 6

Philips DVD 820
DVD Video Player

Philips has added to its range of home video products with the DVD820, a DVD-VCD-CD player which is an updated version of the DVD840 we reviewed in April last year. The karaoke feature has been dropped, but new features include a parental lock facility and a somewhat easier to use remote control.

by Jim Rowe

HAPPILY DVD players now seem to be reaching the Australian market in a steady stream, with new models appearing from both the firms who had first-generation models, and those that didn't. It's all adding up to a wider range of choices for consumers — although sadly, the software side still hasn't caught up as yet.

Philips has of course been a leader in the DVD player market, which you'd perhaps expect considering their key role as a developer of both CD and DVD technology. We reviewed the DVD840, one of their first production models released in this area, in the April issue last year. Since then the market has changed and become more established, and Philips has now released the new DVD820 — which seems to be an updated version of the 840, and like it produced in Asia specifically for the markets in Asia and Oceania.

The DVD820 itself looks very similar to the earlier unit, measuring 430 x 308 x 81mm and with almost identical styling. The only real difference on the outside is that the new model lacks the microphone input jacks and volume controls in the lower right-hand corner of the front panel, which were included in the earlier model as part of its 'karaoke' function. This has now been dropped — which probably won't worry too many Australian buyers, as it appealed mainly to Japanese and Korean buyers.

The only other external difference is that the remote control supplied with the new DVD820 is somewhat more compact than the one for its predecessor, and with the buttons laid out in a more user-friendly manner.

Like the earlier model, the DVD820 employs dual objective lenses on the laser pickup, with one lens used for playing DVDs and the other for CDs (including video CDs) respectively. The right lens is swung into the optical axis automatically, when the player identifies the type of disc you've loaded. This ensures optimum playback of either, despite their different pit size and track pitch.

There's a single laser, however, with a wavelength of 650nm (i.e., visible red), so like many DVD players the DVD820 isn't compatible with CD-R discs. Apparently their dye-layer recordings aren't sufficiently reflective at 650nm, it seems.

An interesting new feature on the DVD820 is a 'parental lock' option, whereby you can set the player to recognise DVD video discs provided with PL rating coding and play only those scenes which are allowed for viewing at the selected 'censorship level'. If the PL feature is activated (which involves a special procedure, with a four-digit security code), you can set the player to one of eight 'viewing levels'. Then it will only play discs and scenes that are below that level. The four-digit code must be entered again to change the level or disable the PL function.

"Once you've watched a few DVDs on a player like the DVD820, your VCR will never seem good enough again"

Like the DVD840, the new model will play both PAL and NTSC discs (although in this case only those coded for region 4), and provides both composite video and S-video (Y/C) outputs. It will recognise either MPEG2, Dolby Digital or LPCM audio tracks, but has only two analog audio outputs — i.e., the internal decoder provides only 'mixdown' two-channel output, for direct stereo listening or 4/4.1-channel 'analog' surround sound via an external Dolby Pro Logic or similar decoder. However there's also a bitstream/PCM digital audio output, for driving external MPEG2 or DD digital surround decoders for 7.1-channel or 5.1-channel discrete surround.

A feature not always found on modern DVD players is a headphone socket and volume control, which allows for personal listening of either CDs or DVDs.

Trying it out

We ran some quick technical checks on the sample DVD820 shown, and found that it stacked up well. As a CD player the frequency response was excellent, with both channels measuring flat within +0dB and -0.4dB

between 20Hz and 20kHz. The fade to noise linearity was very good too, with a noise floor below that of our measuring setup.

Philips kindly loaned us a couple of DVD movie discs to try it out in a typical home viewing/listening situation, and using these together with a couple we've acquired ourselves, we were able to get a good idea of the DVD820's performance playing movies. Frankly it gave both picture and sound quality which were very comparable with the other second-generation DVD players we've tried recently, and of course a big improvement over VHS tape cassettes. Even more so than with laserdiscs, once you've watched a few DVDs on a player like the DVD820, your VCR will never seem good enough again!

The remote control provided with the DVD820 seems a good deal more intuitive in its operation than the one for its predecessor, so that's a worthwhile step forward.

I did notice that the new player seems to take somewhat longer than most other DVD players to load in a disc and recognise its type, etc. After a few seconds it displays an 'L', then 'Lo', then 'LoA', and finally 'LoAd' — followed by another short pause, after which it shows the disc type, number of tracks etc., and at last begins playing it. Frankly I can't recall if the DVD840 was this slow; perhaps the new model is being especially careful...

On the whole, though, the DVD820 seems a good performer and nice example of a second generation DVD player. There's no built-in DD or MPEG2 surround decoder, but then with an RRP of $1099 it's significantly lower in price than those which do provide one. If you already have a decoder, the DVD820 would be well worth considering. ❖

Philips DVD820

A second generation DVD player, also able to play video and audio CDs.
Good points: Good performance on both DVDs and CDs; easy to use remote control, optional 'parental lock' feature.
Bad points: Seems a bit slow to recognise discs; lacks an inbuilt decoder for DD or other digital surround sound.
RRP: $1099.
***Available:** Philips Electronics dealers. For more information call the Philips Customer Hotline, 131 993.*

OPEN Fist

Comet Assays and RF cell damage...

by Stewart Fist

READERS ARE probably familiar with the idea of *electrophoresis*, although they may not know the term. The technique is used for DNA fingerprinting, to determine paternity.

In television documentaries we often see forensic scientists holding a small X-ray film with lines of bar-codes. These bars are the physical locations of the genetic material after the DNA strands have been chemically separated, broken up and dragged through a viscous gel towards an anode. The bars mark the cumulative 'lodging place' of many identical DNA pieces from many different cells.

We have the same DNA in every cell of our bodies, and DNA molecules are negatively charged. Each piece has a different physical resistance, so these bars mark the cumulative lodging place of many identical DNA genetic parts.

During the years of childhood and growth, cells are constantly dividing and duplicating by a process called 'mitosis', so it is especially important that the DNA replicates accurately and that the gene sequences remain in order; these two-metre helical strands of paired molecules contain the basic blueprint for constructing and maintaining viable life.

There are 50,000 billion cells in the body, and even in older people the body is still actively creating another billion new cells every hour, so the incorruptibility of DNA is all-important in our health and survival.

Despite this constant manufacture of new cells, we don't keep growing in size after adulthood. A few die from normal wear and tear ('necrosis'), but to maintain the balance, mis-copied or unwanted cells are instructed to suicide ('apoptosis') by the cells nearby.

Programmed cell death is therefore an essential part of life, and if this euthanasic message fails to trigger suicide and the cell goes into a phase of uncontrolled division, tumours and cancers result.

The cells of the heart muscle, and those of the nerves and brain neurones don't replicate, but all others are reproducing regularly over your lifetime. So at the molecular-cell level, there's a new you about every five years.

This raises the question: Why do we get cancer? Cancer is slow in onset; it generally takes between 10 and 20 years to incubate. Why do we get it at all, if most cells are only five years old?

Obviously the defects which cause uncontrolled cell growth are often (but not always) transmitted from mother-cells to daughter-cells during mitosis. Defects like these are called 'mutations' — however not all mutations are disruptive or dangerous to our health. DNA in our cells constantly comes under attack from many sources, and the normal body processes ignore or handle most of the defects.

External messages are also transmitted across cell boundaries and between cells to initiate apoptosis (programmed cell death), but these may similarly be short-circuited or distorted in some way. These messages are carried by electrically-oriented flows of ions and by more complex protein and enzyme molecules.

The point is, that at the molecular level, human cell functions are very dynamic, very regenerative, constantly being disrupted and repaired, highly tolerant of defects, and very much affected by electrical influences.

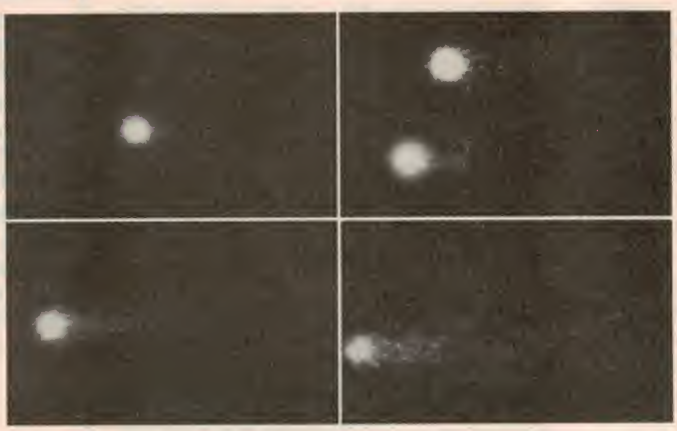


Fig.1: 'Comet assays' showing DNA single strand breaks in human lymphocytes from varying exposures to X-rays. At upper left is the control; upper right, 6.4 rads; lower left, 12.8 rads; and lower right, 25.6 rads. (Courtesy Dr Henry Lai)

Comet assay

Recently the biomedical researchers have begun using a technique similar to DNA fingerprinting to investigate damage to DNA. This is called single-cell gel (SCG) electrophoresis or 'comet assay', and it is capable of finding defects in single cells exposed to toxic chemicals or ionising radiation. The technique gets its name from the comet-and-tail appearance which results from broken genetic material being dragged through the gel by electrical attraction, ahead of the more-resistant DNA bundles.

Think of this as towing a very old car through a few miles of deep mud, then counting the bits and pieces that fall off in the process. But here the car (the DNA ball) drags behind and the broken bits move out ahead.

Our interest here is in whether this technique can detect damage to cell functions or DNA viability, from low level radio waves. Classical radio theory says radio waves can't damage molecules, because their energy is not sufficient to break chemical bonds.

Fig.1 shows the comets from immune cells which were subject to various levels of X-ray exposure for calibration purposes. This sequence establishes the fact that the breaks in the DNA are dose-related: higher exposures produce more and therefore longer and more complex comet tails.

Comet assay techniques were developed by Swedish scientists Östling and Johanson in 1984, and then later refined by Narendra Pal ('NP') Singh in 1988 (with other improvements later). At that time Dr Singh was a research scientist at the US National Institute on Aging.

Chemical processes are employed to digest

and remove all the lipids and proteins from the cell to express the DNA breaks, and Singh's alkaline separation techniques are now widely recognised for their sensitivity and reliability. Alternative 'neutral' approaches are applied also in some research laboratories.

Comet assays reveal damage to DNA from air and water pollution, food additives, diet and smoking, etc., and they always require very highly developed laboratory skills and strict attention to detail. Unfortunately they lack a recognised form of objective measurement.

Back in 1994, Singh joined biomedical scientist Dr Henry Lai at the Bioelectromagnetics Research Laboratory, University of Washington in Seattle. The work originally conducted at this university was funded by the US Navy and Airforce, but that source of funding has long evaporated. Under Henry Lai, the US government's National Institutes of Health has been responsible for most of the funding.

In a ground-breaking series of experiments between 1994 and 1998 they demonstrated convincingly that moderate levels of microwave (2.45GHz) radiation, for exposures of only two hours, could increase the frequency of single-strand DNA breaks in the brain cells of live rats.

Fig.2, from Drs Lai and Singh, shows the results of comet assays at power densities about *one-fifth* those previously thought to cause adverse biological effects. The cells have the classic comet tail of particles indicating extensive DNA damage, well above the spontaneous DNA damage levels of the control cells.

Spontaneous breaks are relatively common in all cells (free-radical attacks seem to be responsible) and most are quickly repaired by normal cell processes — generally within minutes or hours. But any form of increased disruption to the DNA is worrying. Nerve cells in particular have a low capability for DNA repair and so the effects of additional breaks could accumulate.

The DNA strands form a spiral-staircase-like helix, and so breaks on only one side of the ladder are much easier to repair than those where both sides are broken. But in later experiments Lai and Singh found *double-strand* DNA breaks after similar exposures times and levels.

It is possible for the cell to make mistakes when repairing single-strand breaks, but the likelihood of serious mistakes (mutations) increases substantially with double-strand breaks.

Fortunately, only certain genes are 'expressed' (activated) within each organ, so less than 1% of the DNA is essential in any one cell. Most mutations will cause no harm, and those that are very disruptive will probably lead to programmed cell death.

This introduces a paradox: small problems accumulating over time may be more dangerous than large defects. Cells that suffer gross disturbances to their critical genes are also more likely be programmed to suicide; therefore the larger DNA disruptions may be self-annihilating.

Fig.2: Comet assays of live-rat brain cells irradiated with 2.45GHz at power densities only one fifth that previously thought to be capable of adverse effect. (Courtesy Drs Lai and Singh)

Over the years the DNA in human cells constantly suffer attack, some of which is never repaired. Given enough time, the accumulation of minor (but collectively critical) problems can cause cancer to develop. There is rarely a single cause of cancer.

This is also why cancer is mostly a condition of age. It's probably that older people have many pre-cancerous cells, even though only a few suffer the critical mutations that lead to uncontrolled cell proliferation. These are just the straws that finally broke the camel's back.

This raises the distinct possibility that cumulative low level RF exposures could be more harmful than higher critical exposures.

And since nerve cells don't divide and proliferate, this damage could equally contribute to degenerative diseases such as Parkinson's and Alzheimer's. Cancers and age-associated degenerative conditions may be closely related.

Another aspect of the Lai-Singh research (with pulsed microwave similar to GSM cellphones and radar) was also disturbing. Rat brains which were excised and prepared quickly for the assay showed fewer breaks, while those which were checked four hours after exposure revealed much higher levels. This suggests that both the damage and the repair-initiation are not simple and immediate processes, and supports the thesis that DNA damage from repeated uses of a cellphone could be cumulative.

Dr Jerry Phillips, working in a research facility outside Los Angeles, made a similar finding. His research showed that DNA breaks actually decreased in some RF exposure conditions, sometimes with different waveforms, suggesting that there's a more complex causal link than expected, and a delicate balance between the break and repair-rates.

Phillips work also suggests that there may be some type of rough feedback control mechanism — something like a sticky flywheel governor on a steam boiler which makes the engine-rate 'hunt' between slow and fast. The DNA-repair feedback might lead to mistakes and mutations and increase the chance of destructive cancer.

This work is highly controversial, as you'd imagine. Lai and Singh have reported finding of DNA strand breaks at levels of only one-fifth the American RF safety limits — but they've since also found that they can use the pineal hormone melatonin and other anti-oxidants to countering the RF effect. So the research is not only producing negative results.

This points to the importance of free-radicals as the intermediary which actually damages the DNA, which doesn't come as a surprise to most researchers. Free-radicals have often been implicated in DNA problems.

Although the Lai-Singh research hasn't been faithfully replicated, other scientists have found similar DNA strand breaks in parallel radio research projects, and a number of live-animal tests have confirmed increased tumour rates resulting from long exposures over the life of the animals. There is also evidence that radio-wave exposures can influence the short term memory.

"Lai and Singh have reported findings of DNA strand breaks at levels of only one-fifth the American RF safety limits..."

Currently, the Lai-Singh research has been stymied for lack of funding from the US government which has its attention focussed on other matters, while the cellular phone industry has preferred to invest in less disturbing projects. ❖

Forum

Conducted by Jim Rowe

Subtle energy medicine, EMF dangers and motor home cutout relays, all revisited...

Yes, this month we're again throwing caution to the wind and revisiting some familiar controversies, folks. So step right into the Forum tent, get comfortable, take a deep breath and enjoy the show. There's laughter, tears and even a few sobering facts to digest. No popcorn though — sorry!

I WAS QUIETLY exchanging emails the other day with regular *EA* contributor Jim Lawler, when he noted that he'd been finding our coverage of 'subtle energy medicine' here in Forum quite interesting and entertaining. But, he politely enquired, why hadn't I elected to use the story he'd sent me, about *his* experiences in this context?

But I *have* used it, I replied — I've used your item about Bell's Palsy in the March column; it was probably rolling off the presses as we were communicating...

No, no, he replied, not THAT one. The other one, about my experiences with a local doctor who practices electromedicine. Why didn't you use that one?

Well, to cut a long preamble short, it turned out that I hadn't used it because he hadn't actually sent it to me. A pretty good excuse, I thought...

Anyway, he promptly *did* then send it to me, and I enjoyed it so much I've decided to use it to kick off this month's column. So without further ado here it is:

The current discussion in Forum about 'Alternative Therapy' prompts me to relate my own experience with this 'science'.

Some eight years ago, I was suffering severe abdominal and chest pains. The GP I was consulting at the time could not make much out of the symptoms and prescribed various gastric remedies. When these didn't alleviate the symptoms, he tried other drugs, including various ulcer treatments. Nothing gave more than momentary relief.

I was complaining about my lot to a colleague, when his wife suggested that I see Doctor Soandso. "He's a medical doctor who has studied naturopathy and he's very good". She went on "He cured Mrs Whatname who had symptoms just like yours, and Mrs ....", listing another half-dozen people whose names meant nothing to me.

Although I had no knowledge of, nor faith in naturopathy, I had an open mind and was prepared to give anything a go, if it promised relief from my symptoms. So I eventually faced up to Dr Soandso and to give him his due, on this first visit he gave me a very thorough physical examination. He was very observant and even picked up the first signs of incipient arthritis, which I hadn't noticed.

On this first visit he didn't cure me, but did prescribe some herbal remedy and asked me to note any changes in my condition after I started taking the medicine. Apparently, my response to this medication would determine his future diagnosis and treatment. I took the foul-smelling brew for a fortnight, then reported for my second consultation.

As far as I could tell, there had been no change in my condition or habits, which seemed to please him. His only comment was that this should make further treatment simpler. He went on to explain that he was going to use 'Electro-chemistry' to determine what was ailing me, after which he could devise a course of treatment to ease the symptoms, even if it should prove impossible to cure the complaint. That sounded a bit like a cop-out to me, but I was prepared to go along with him, for the present.

Modified projector?

His 'Electro Chemistry' machine looked to me very much like a cut-down 35mm slide projector, mounted in the top of an instrument case with some switches, knobs and a small milliammeter on the front panel. A flexible lead from the back of the case terminated in an instrument probe fitted with a not-too-sharp point.

Next, he took from a cupboard a box of what looked to me like 35mm colour slides, explaining that these were 'samples' of various processed foods and common chemicals that were 'known' to cause trouble in susceptible people. His tests would be to see if I reacted badly when stimulated by these materials.

To test me, he asked me to remove my right shoe and sock. He then put the first of these 'samples' in the slide carrier, and pressed the point of his probe into the end of my big toe. Nothing happened, so he removed that slide and selected the next one. This produced a beep from the instrument, so he put that slide to one side. This went on for 30 minutes, through two or three boxes of these 'samples'. Eventually, he had a couple of dozen slides that had produced a beep and these, he asserted, were the materials that were causing my trouble.

He examined the problem slides carefully, and consulted several thick 'medical' books before solemly advising that my trouble was caused by 'oatmeal'. His advice was that I should avoid anything containing oats or oat products, and I should limit my intake of other grains, relying instead on beans and green vegetables. He would also prescribe several herbal and natural additives which would help to "cleanse the system of the oaten poisons!"

By this time I'd had just about enough of this mumbo-jumbo, and was about to tell him so when the phone rang in the office. He left the room to answer it and I took a quick look at the 35mm 'samples'. As I suspected, they were only 35mm slides; the one I grabbed from the top of the stack was a picture of a bowl of porridge!

Needless to say, I haven't been back to that doctor. But I did find out what my trouble was (and still is). My regular GP was away and his locum looked at my records and immediately referred me to the Royal Hobart Hospital Cardiac Clinic. Within a few days, I was admitted for a full angiogram and the cause of my distress was revealed — acute coronory artery occlusion.

As it turns out, the only thing that will 'cure' me is a multiple bypass operation. In the meantime, adequate control is maintained by the administration of scientifically proven medication. As for avoiding oatmeal, that was totally useless advice, or worse. In fact I have to get my weight down and crude grains, including oatmeal, are all unrestricted on my diet.

I don't know if Dr Soandso really believes what he told me. If he didn't know what was wrong with me, and I don't think he did, it could be that he was trying to generate in me some kind of psychological state so that I could ignore the symptoms. I understand that this can happen with susceptable patients.

But if he was trying to mask my symptoms, it was a dangerous practise since my trouble was real and potentially fatal.

And finally, I don't know what he paid for his 'electro-chemistry' set, but it looked to me as if he had bought the parts at Dick Smith Electronics, and put it together himself.

Thanks for that bitter-sweet tale, Jim. I can assure you that if you'd sent it earlier, I would certainly have used it before this. I'm sure the readers will agree that it was too good to waste — while also wanting to join me, no doubt, in sympathising with you regarding your unhappy discovery of coronary heart disease.

The other aspect of your tale that I found very sobering was the implication that such a crude and shonky 'electro-chemistry' setup was being used by a supposedly qualified medico. Somehow it wouldn't be so frightening if he had been a maverick mushroom farmer-cum-radio amateur, or even a misguided physiotherapist. But if this sort of thing really is being pushed by a qualified medico, it suggests that they're either someone suffering from serious mental deterioration themselves (i.e., they've lost the intellectual faculties they would have needed to get through medicine) or are a complete charlatan. Either way, it suggests they should be investigated promptly by the authorities.

As you say, this so-called doctor's little show really had the potential to do much more harm than good. If you'd swallowed his 'diagnosis', you wouldn't have sought proper diagnosis and treatment for a very serious condition. I just hope that other people with equally serious conditions haven't received the same 'treatment'.

EMF health risks

Moving on a little, let's return to one of our other thorny topics that keeps on keeping on: EM fields from things like cellphones, and their possible health risks. The feedback I've been getting on this one is almost equally divided, with half those that write congratulating us for being prepared to publish material drawing attention to the possibility of health risks, and the other half berating us for doing the same. (It's the old story of 'damned if you do, damned if you don't!')

Anyway, a few weeks ago I noticed that an email list to which I subscribe had distributed a very interesting piece that a recently retired scientist (and now independent consultant) had written as a 'Letter to the Editor' for his local newspaper, the *Glen Ellyn News* (it's a city in Illinois, USA).

The scientist is Dr Bill Curry, and his preamble explained that the letter was sent in response to the statements made by an environmental engineer, in a previous letter to the editor, questioning whether there were any reputable scientific studies supporting the notion of cellphone-related health issues.

Dr Curry's letter, titled 'Scientist Warns of Antenna Radiation', was so concise and informative that as soon as I read it, I decided *EA*'s readers should have the opportunity to read it too. So here it is:

I am a former staff physicist at Argonne National Lab. This letter is in response to the letter of Jeffrey Gahris in the Oct. 9, 1998 issue, titled 'Water Tower Heats Up'. Jeff Gahris stated 'An Internet search revealed that 'studies' have found dangers, but the evidence put forth has not been accepted as good science'. I challenge that statement. Gahris should read the FAQ by Dr John Moulder at the Medical College of Wisconsin, as I think he did, but disregarded Moulder's comments and read his references instead.

I have been investigating this issue since early spring, have read numerous papers from refereed journals, some of which I shall cite here, and have attended two scientific meetings dealing with this and related subjects, and I think a consistent picture of vulnerability is emerging.

There are some electrosensitive individuals who have allergy-like responses when exposed to microwave radiation and some other forms of electromagnetic radiation, as well. I have personally met a number of these people, and a journal article about their plight to which I have just been referred is C.W. Smith, R.Y.S. Choy and J.A. Monro:

'The Diagnosis and Therapy of Electrical Hypersensitivities', in Clinical Ecology 6:119-128 (1989).

In-vitro studies in the laboratories of Professors Martin Blank and Reba Goodman at Columbia University have shown that low level sinusoidal magnetic fields can affect biological enzyme reaction rates, and cells go into a protective mode when bombarded with AC magnetic fields and generate 'heat shock proteins', which are nature's way of protecting cells against lethal and environmental stresses. The fluctuating magnetic field intensities in which these events occur are quite low and the frequency range extends over several thousand Hz, incorporating the frequency range of audio modulation of cellphones and the pulsing rate (approximately 200Hz) of PCS phones. Their work is cited in Cell Stress and Chaperones, 3:79-88 (1998) and Bioelectromagnetics 18:111-115 (1997) 3).

In four different laboratories (Lawrence Berkeley National Lab, University of California Riverside, US Environmental Protection Agency Lab, and Battelle Pacific National Lab), investigators have found low level sinusoidal magnetic fields can block the ability of Melatonin and Tamoxifen to inhibit breast cancer cell growth. This work is too recent to be published yet, but I heard papers on it in a recent meeting in Tucson. Also, mice that were genetically predisposed to have lymphatic cancer were found to be more likely (by a statistically significant ratio) to develop cancer in the presence of fields simulating pulsed cellphone radiation than predisposed mice not exposed to the radiation. M.H. Repacholi, A Basten et al: 'Lymphomas in E5-Pim1 Transgenic Mice Exposed to Pulsed 900MHz Electromagnetic Fields', in Radiation Research 147:631-640 (1997).

DNA strand breakage and failure of DNA repair mechanisms upon exposure to electromagnetic fields have been reported in several articles, one of which is H. Lai and S.P. Singh: 'Acute low-intensity microwave exposure increases DNA single strand breaks in rat brain cells', Bioelectromagnetics 16:207-210, 1995.

Another is H. Lai and S.P. Singh: 'DNA Single and double strand breaks in rat brain cells after acute exposure to low-level radio frequency electromagnetic radiation', International Journal of Radiation Biology 69:513-5216. Microwave fields were found to increase the mutation rate of DNA in the presence of a carcinogen over that due to the carcinogen alone. A. Maes, M. Collier et al: '954MHz microwaves enhance the mutagenic properties of mitomycin C', in Environmental Molecular Mutagens 28:26-30, 1996).

Epidemiological studies have shown that children living near a certain radar installation were more prone to leukaemia than the general population, in S. Milham: Leukaemia clusters, Lancet 2, 1122 (1963).

In ham radio operators classified by age and licence class (experience level), the technician class (experience level just beyond novice, permits more powerful transmitters) has 60% higher standardized mortality rate due to leukemia than the general population, in S. Milham: Carcinogenicity of Electromagnetic Fields, European Journal of Oncology 3: 93-100 (1998).

Epidemiological data from all over the world showing an association of cancer and other maladies are analyzed in J.R. Goldsmith: 'Epidemiologic evidence relevant to radar (microwave) effects', in Environmental Health Perspectives , 5:1579-1587 (1997). Also, Dr Goldsmith has compared microwave radiation, including cellphone radiation, with other public health issues in J.R. Goldsmith: 'From sanitation to cell phones: participants and principles involved in environmental health protection', Public Health Reviews 25: 124-149 (1997).

Bill P. Curry, PhD.

As you can see, Dr Curry has presented a calm, concise and helpful reply to those who claim that fears about the health risks from cellphones are all emotive and non-scientific scaremongering. He has also provided all of the references needed for further reading, just as you'd expect from a trained and experienced researcher. What more could you ask, in terms of credibility?

By the way, Dr Curry said in his preamble that he didn't mind the letter being published elsewhere, so that's why I've taken the liberty of publishing it. He also has his own home page on the web, at **http://www.EM-SciTek.com**, if you're interested.

Motor homes & EMC

To end up this month, you may recall that in the January column I presented a letter from reader Darrin Wilson, on the subject of EMC compliance and the reason for cutout relays that seem to be fitted in some motor homes. You may recall that this subject had been raised by UK reader Paul Coxwell, in a letter I'd published in the October 1998 issue, and Darrin Wilson was somewhat critical of Mr Coxwell's explanation for the purpose of those cutout relays — which disconnect power to many of the motor home appliances when the engine is running.

Well, Mr Wilson has himself come in for some criticism, not from Paul Coxwell but from a fellow Aussie reader in Victoria, who although he supplied his full name and email address has asked to remain anonymous here. Here are his comments, which are again quite interesting:

I have just finished reading the January 'Forum' and feel that I must reply to the appalling rubbish spouted by Darrin Wilson, claiming that radiation from the motor home's wiring is the reason for the cut-out relay fitted to the ignition. If Mr Wilson really knew anything about EMC he would realise that there is a much more compelling reason.

The European EMC standards are divided into varying levels of 'strictness'. Obviously medical and military applications are the most stringent, but in this context the requirements for automotive EMC approval are vastly more stringent than those for normal domestic appliances.

The reason for this is that vehicles are in the unique situation of requiring a wide range of diverse equipment to operate in very close proximity, with perfect safety. Consider that 100 watt HF radio transmitters, VHF/UHF transceivers, hand held radars, CD players, AM/FM radios, tape players, etc., will at times be jammed into the confines of a modern car. As well as this, vehicles will often drive close to very high power radio and television transmitters.

'Ferocious tests'

In addition, there are ferocious tests required for over-voltage, reverse voltage, voltage spikes, etc, which any automotive 12 volt equipment must be designed to survive. The dreaded 'Load Dump' test alone can cause a design engineer to loose much sleep. It requires about 200V to be applied to the device via a huge bank of electrolytic caps. This test will blow every light globe in your product. They go off like flash bulbs!

I have not even begun to talk about the extreme temperature and humidity requirements for automotive electrical equipment.

The rule is that if any of the equipment in the mobile home can be operated when the engine is running, then it must be approved to the stricter Automotive Standards rather than to the Domestic EMC standards. I doubt that any such domestic equipment exists. If it did, it would be impossibly expensive.

If Mr Wilson is reading this, I trust that he now understands why the mobile home in question was fitted with a cut-out relay.

Hmmm. Thanks to our anonymous Victorian correspondent for that further information, which does throw further light on the reasoning behind those initially rather puzzling cutout relays. I have to confess that as an 'electronics GP' with very little detailed knowledge of either motor homes or European EMC regulations, I'm not in a position to judge which of the various explanations is more accurate. That's why I've published them both, so you can all make up your own minds.

As that's all for another month, folks. Please consider our cleaners and throw all of your lolly wrappers in the bin as you leave. And I hope you'll join me here again next month. I'll try to find something on topics other than EMFs, just for a change. ❖

Serviceman

The church PA system that hummed, and the electronic scale that teemed with life!

Our servicing stories this month come from many different areas of electronics. One is about a hum which persisted in a church PA system, despite intensive efforts to eradicate it; another is about a very strange problem in a faulty precision electronic weighing machine. And to cap them off, there are a couple of items about faulty production equipment in an electronics factory.

THERE WAS A TIME when almost every story presented in these pages was about five-valve radios. Then in about 1956, TV arrived and most stories were about problems in various television sets.

More recently, with the advent of video recorders, Serviceman stories had been almost totally video orientated. Then I put my foot down with a firm hand (interesting metaphor, don't you think?) and decreed that henceforth, stories would cover the entire range of electronic applications. So that's why you've seen recent stories about scientific instruments, computers, communications equipment, games, clocks, radios, stereos, and only a few TV and VCR items.

This month, there's not a TV or video to be seen. Instead, we open with a PA system yarn, then go on to a scientific instrument repair, and then — well, you'll see.

Our first story comes from Sid Yarrow, of Auckland in New Zealand. As you will see, Sid's story has a religious overtone so we don't know if it was the hand of God that directed him to find a solution to his problem. See what you think!

I don't know whether the following story will interest you and your readers, but there is only one way to find out. Some time ago I was commissioned to re-equip a local church with a sound reinforcing system for both public address and music.

To minimise costs, I built both a power amplifier and a mixer, the latter comprising six microphone inputs plus one line input for tape or CD. The mike inputs are balanced line and I took some trouble to maintain good quality music reproduction.

At the time of installation a number of microphone waylines were run from the front of the church to the rear, where the equipment was sited. Grooves were cut in the concrete floor and the waylines were run in these, under the carpet.

It turned out that the users wanted more waylines than the number of input channels, so I constructed a patch panel with XL type plugs and sockets and this worked well. The patch panel was mounted on a hinged door with a cavity behind for cable entry and socket terminations. The cavity also contained mains cabling, but this did not cause problems, at least initially.

A problem developed concerning intermittent interference from local AM broadcast stations. I duly filtered the input lines with ferrite beads, fitted a ferrite ring choke to the speaker lines and took care to ensure that there were no earth loops; but the problem persisted at times.

I eventually concluded that earth currents from the transmitters were inducing minute but troublesome currents into the

mike lines, since the problem disappeared when the channel input plugs were unplugged from the patch panel.

In the end, I found that the only way to cure the problem was to insert an RF choke into each leg of every mike input line. I used 560 microhenry chokes and because of cramped space in the preamplifier case I elected to fit them behind the patch panel, using tagboards.

I tested each channel at full gain into an open mike input line, and congratulated myself on curing the problem as the interference had disappeared. However my jubilation was short-lived, as a new problem had emerged. This presented as an obtrusive hum when a microphone was used with one particular wayline.

I first suspected an open or shorted line, but this checked out OK. So in order to make testing easier without acoustic feedback problems, I terminated the line with a 470 ohm resistor as a dummy mike. This gave the hum all right — but to my astonishment, the problem disappeared when the dummy load was unplugged!

I decided as a last resort to inspect behind the patch panel. I removed the securing screws and as I swung the panel open, the mains hum faded out!

It turned out that in the problem channel, one of the chokes that I had fitted came into close proximity to a mains cable when the panel was closed and thus there was inductive coupling between the two. It also explained why the hum appeared only when the input circuit was completed by a dummy load.

I made arrangements for an electrician to re-route the mains cables and of course, this cured the problem.

This was a weird one and it highlights the sort of problems that one can encounter with PA systems.

Thanks for that story, Sid — and no, I am not at all surprised at the problems you found. I've had similar problems myself, and oddly enough, usually in churches! I wonder if God disapproves of loud noises in His places of worship?

Stories like yours also explain why professionally executed sound reinforcement systems (PA to us ordinary mortals) are so hideously expensive.

Anyway, it was an interesting item and one that may hold useful ideas for others involved in small-scale PA work. Thanks, Sid.

Alive, on balance

Now we go about as far west as Sid Yarrow was east. To Perth over in WA, actually.

This contributor is Peter Van der Wedden who, as you will see, runs a company specialising in an important but unusual branch of electronics. And in keeping with so many stories recently, Peter is also an amateur entomologist.

Here's what he has to say:

I run a service and sales orientated company specialising in the electronic and mechanical balances used in a scientific environment. My work takes me far and wide around our state of WA, servicing the many mining companies and, of course, many other industries here in Perth which use a balance in manufacturing or research.

In nearly 14 years of service in metrology, I have come across many different brands of both mechanical and electronic balances.

Some months ago I was called in by a research department to repair a semi-micro electronic balance (0.01/0.1mg x 42/210g). The complaint was one of erratic drift, which can be quite common if the load cell gets any foreign materials inside.

The principle of this load cell is based on electromagnetic force compensation. A moving coil in a magnetic field is attached to the pan through a levering system. In operation, the coil will be displaced and an infrared sensor system connected to appropriate electronics drives a current proportional to the weight through the coil, to move it back into equilibrium.

This current passes through a precision resistor and the voltage drop across is digitised by an accurate analog to digital converter and processed to an LCD display. This very delicate weighing system needs to be free moving, which brings us back to the faulty balance.

Since this unit is better serviced in the workshop, I decided to take it with me. I removed the top cover, but had to close it again quickly — so that none of the black ants would take over my clean work area. That's not a joke. The thing was full of small black ants!

I find it strange that small insects have featured so often in these pages of late. So far as a quick search of back issues indicates, mice were the smallest creatures to cause trouble with electronic devices until just a few years ago.

I had chosen the backyard to strip the unit down, which was a good move. A complete nest of ants, including the queen and eggs had made themselves at home between cover plates and in various hide-outs around the instrument.

During the process of disassembling, the ants were busy defending their nest because of my intrusion. I put all of the components in a box and emptied in a can of fly spray for an overnight soak.

Next day, the dead ants were vacuumed out, but I was still left with the problem of removing the carcasses from the load cell. The most time saving way, without disassembling it all and having to use jigs for realignment, was to fill an ice cream container with methylated spirits and wash the load cell clean.

They had even managed to work their way into a separate part of the enclosure which houses the LCD!

After reassembling everything, I was pleased to see a steady display and and I was able to get accurate readings by using my test weights.

It seems that the client had done some tests on sugar, and over a two weeks period had developed the ant problem. It amazed me just how quickly the ants managed to establish a colony in this rather cosy and warm environment.

I have had to remove cockroaches in similar circumstances before, but never hundreds of ants!

Thanks for that story, Peter. From the number of ant and insect stories in these pages recently, we might have to add 'and Entomology' to the title of this magazine...

I find it strange that small insects have featured so often in these pages of late. So far as a quick search of back issues indicates, mice were the smallest creatures to cause trouble with electronic devices until just a few years ago.

Insects could do little to damage old-time valve equipment, and not much more to trouble early solid state gear. But with some components now smaller than many insects, and some parts even approaching the size of ants, it's not surprising that the insects are able to cause problems, if not actual damage.

Thanks again, Peter. In a way, it's nice to know that even professional and scientific gear can be subject to the depredations of the little beasties, just like consumer gear.

Wave solder machine

Now we come to the final contributor for this month, a technician who asks that he be identified only as 'AC'. We're always happy to oblige, since in this case, at least, identification could be a little embarrassing.

AC's story comes right from the heart of the electronics industry, the production line that assembles the bits and pieces that we work on each day.

Electronics assembly was once done by real people, but modern factories rely almost entirely on machines. And most of these are electronically controlled. Our contributor tells here of just two of the problems that can face a modern production line:

I work for one of the multi-national electronics companies in Sydney, maintaining the production machinery that manufactures printed circuit boards for telecommunications equipment.

One morning, when I arrived at work, I was confronted with a severe problem with our one and only wave soldering machine. It appeared to have a power supply failure, and as all of our printed circuit boards have to progress through this machine, the management were very interested in having it back in production ASAP.

The first symptom was that there were no indicator lights on the front panel. I checked the large control box at the rear and found the LEDs on the PLC (Programmable Logic Controller) Input and Output modules all glowing as normal. (This machine is controlled by a stock standard PC, which drives the PLC which has its program burned into an EPROM module).

My next idea was to measure the 24 volt power supplies. The main rail was reading almost zero volts and was probably in current limit mode, so to prove this I disconnected its output lead — and of course, it came up to 24V.

At least this proved the limiting circuitry was performing properly. (The PLC modules run on their own power supply.) Whilst the output lead was off, I measured only a few ohms across the output wiring, suggesting a short circuit or close enough to it.

The problem then was where to find the short, as this large machine (about 10 metres long) has a lot of equipment connected to the 24V bus.

There was really only one approach to this: start disconnecting the wiring from the terminal blocks, being careful to note where the wires came from and to monitor the rail until the short disappeared.

The wiring was alternately disconnected and reconnected from the terminal blocks inside the 10 or more plastic boxes that protect the wiring connections, until finally I struck oil. A three-wire cable was the culprit, and was traced to an inductive sensor inside a fibreglass sheath which protects it from the heat above the solder pot.

This sensor tells the PLC that the solder level is within limits. The cable to it is stock standard PVC which, surprisingly, had withstood the heat attack for about three years.

The moral of this story is that every three years we should replace this sensor, or at least, given an almost dead machine, check this device first. Of course this problem took quite some time to find and having had the power off, the solder pot had cooled and took three or more hours to regain its operating temperature...

Various management persons had visited during the down period and then wandered off to contemplate their ulcers. Everyone was glad to see the machine producing again for the afternoon shift.

Component inserter

My second story is about a machine which inserts components into PCB's. When powered up after a mechanical service, the machine would not proceed after its zeroing sequence had been completed. A colleague had already been over most of the likely culprits, so I foolishly volunteered to help him.

Individual functions of the machine can be operated via a diagnostic routine and my colleague had concluded that none of this routine was working. However I found that the 32-way output card would operate about half of the output module functions.

Obviously he had not gone far enough in trying these and had defeated himself on this occasion. I found that some of the functions that could be operated were just turning control lamps 'on' and 'off' on the front panel. Some of these functions appeared dead because there were about six of the lamp filaments blown.

Once these were replaced, diagnostics were shown to work in this part of the machine — but still not on the other output modules. This part of the machine has the TTL output card from the computer, which then drives the output modules and thus the associated wiring and connectors. So there is not very much to investigate.

Other, more important jobs had to be done so this machine was left and the manufacturer's service agent was called by the management.

The service technician duly arrived the next day. He checked our work and came up with the same conclusion, but noticed that one pin on the backplane was much lower resistance to earth than the rest.

Associated cards were removed and also the ribbon cable to the computer board, but the lower resistance was still there.

He next looked at the wire wraps and checked that no pins were shorting to others, before finding that one wire was going to an input card next to the output card.

This input card had no association with the circuit area we were dealing with, but on removal proved that something on it was causing the mystery low resistance. This was holding down the logic signals from the computer.

This 'something' proved to be a $1.40 IC logic gate that had become faulty. A replacement board was fitted and the service guy was officially exonerated.

This story serves to remind us that when faultfinding, one sometimes needs to look into different areas than those to which the symptoms are pointing.

I thoroughly agree with you, AC. I don't know how many times I've tagged a component as faulty, only to find when I had replaced it that the fault lay somewhere else!

It all comes down to the need to have an intimate knowledge of how the device works and 'what would happen if...'! Then you run through the various 'ifs' and pick the one or two that seem most likely.

Fifty years ago machines (and electronics) were so simple that there were only a few possible faults. Today with logic and computer controls, things are so complex that there are an infinite number of possible symptoms and almost as many faults.

Thanks for those stories, AC. We haven't been into an electronics factory before and your contribution corrects that omission.

And that's it for this month. I have more stories lined up for next time, so keep watching. ❖

Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

High-Power Alarm/Siren Driver

This circuit allows an alarm system to deliver high power into speakers from a 12V lead-acid battery. It will deliver a genuine 100 watts into a 1Ω load. The idea is to use multiple speakers, salvaged from old stereos, car radios or TVs, arranged in a series/parallel network depending on the nominal impedance and power handling of each. The whole speaker system should not present a load of less than 1Ω.

The output stage is a bridge configuration using garden variety transistors directly across the power supply with no limiting resistors. For this reason it's important that two transistors on the same side of the bridge do not conduct at the same time (Q1 and Q2 or Q3 and Q4). To ensure that this doesn't happen, we introduce some dead time (crossover distortion if you like) between the conduction of Q1-Q3 and Q2-Q4. This is done with a 4520 four-bit counter, decoded so that in states 1 to 7, Q2 and Q4 are conducting and in states 9 to 15, Q1 and Q3 are conducting. States 0 and 8 are dead time with no output device conducting.

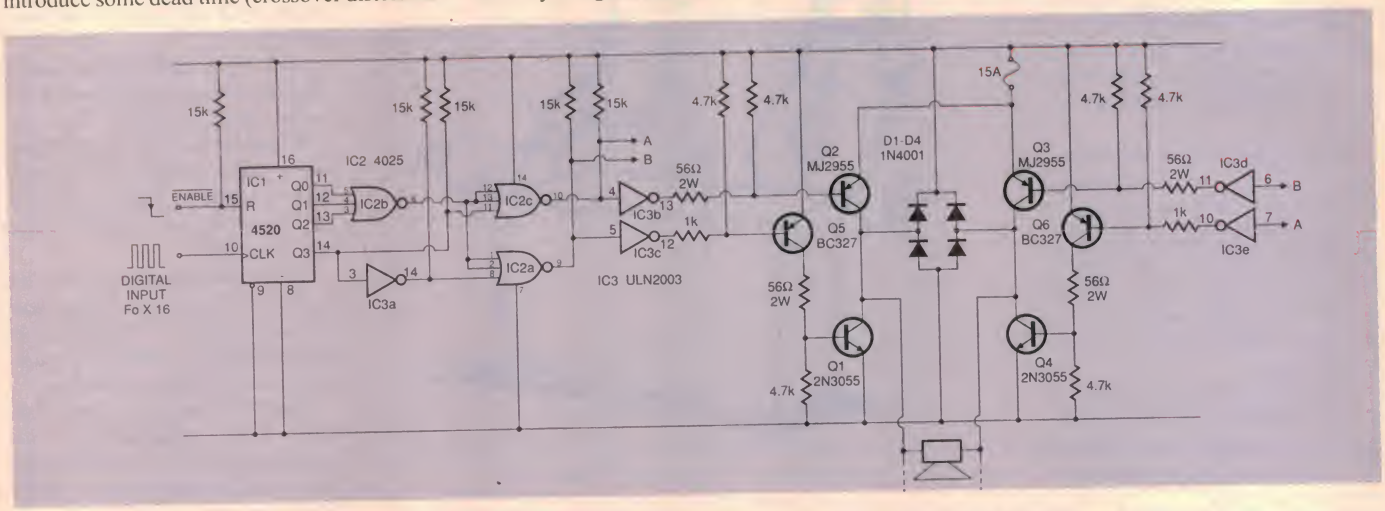
This means that the input signal must be 16 times the output frequency. For a digitally generated signal, this should be a simple matter of clocking the generation circuitry 16 times faster. Chances are that the removal of the input signal would leave the counter in a state other than 0 or 8, resulting in DC flowing through the speakers. For this reason we use the enable input to turn the sound on and off — when the enable line is taken high the counter is reset to state 0 regardless of the signal input.

Note that this circuit is only suitable for drive by a digital pulse train. Do not attempt to put analog audio into it or you will discover a new meaning for the word 'distortion'. Only modest heatsinking is required for the power transistors. If two heatsinks are used — one for Q1-Q2 and one for Q3-Q4 — then the collectors can be bolted on without insulating washers.

When testing or de-bugging this circuit, use a current limited power supply since (by Murphy's law) any fault will result in the destruction of the output transistors. Also, when installing use a 12V lamp in place of the fuse, and insert the fuse as the last step. The fuse will not save the output devices — it's there to stop the wiring going up in smoke.

Graham Leadbeater
Ringwood, Vic. **$40**

THIS MONTH'S WINNER!



Brakelight Monitor for cars & trailers

Here's a circuit which I have developed for the monitoring of stoplights on my car and trailer or caravan. I have had this unit working for a number of years and found it to operate very satisfactorily. With fines as they are it's also a very useful device, as it monitors for both inoperative lamps and high resistance connections.

Power is not applied to the circuit until the brake pedal is depressed and the stop light switch is closed. When this occurs, the current to the stop lights flows via the shunt resistor R1. The 100 ohm preset potentiometers in parallel with this resistance are for trigger level sensing.

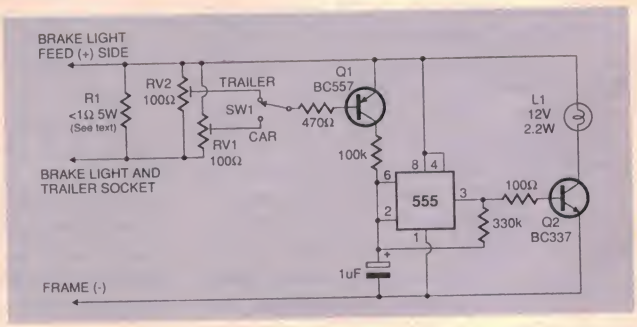
The heart of the system is the 555 timer, which is connected as a free running multivibrator that is controlled by transistor Q1, which at this stage we will assume is conducting. This being the case, pins 2 and 6 of IC1 are held high, which inhibits IC1, whose output at pin 3 is held low, Q2 is turned off and the warning light is off.

If there is a fault with the stop lamp circuit, the voltage drop across the shunt resistor is less, decreasing the emitter/base voltage on Q1, turning Q1 off and allowing IC1 to oscillate. The output of IC1 then flashes the warning light via Q2.

When SW1 is in the 'car' position, RV1 is adjusted so that with the stoplights on, the warning lamp just stops flashing. If a trailer is to be connected, turn SW1 to 'trailer' and with the stoplights on, adjust RV2 until the warning light stops flashing.

For the main shunt, select a 5W resistor that will give a drop of around 1V when the stop lamps are on — something around 0.15Ω for an 80W load, or up to 0.33Ω for a 40W load.

Ian Combridge,
Bell Post Hill, Vic. **$35**



As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is an open order to the value of $300 from Oatley Electronics! Yes, that's $300 to spend on anything you want from Oatley's wide range of products, so check out their ad (or their Website) to see what's on offer.

Win our 'IDEA OF THE MONTH' Prize!

Door Watcher

A friend runs a small business in a busy shopping centre. The premises consist of a number of rooms having no direct line of sight into the showroom. Over the years he had tried a variety of 'door minders' such as light beam, pressure mats and the like, but frequently someone stood on the mat or in the doorway, with a consequent continuous ring, drone or buzz, to the annoyance of staff and customers alike. Also, staff had a habit of leaving the storeroom doors open — leading, on occasion, to easy theft of stock.

My solution is as shown. The circuit is powered by a 6V lantern battery, and no current is drawn unless a door is open.

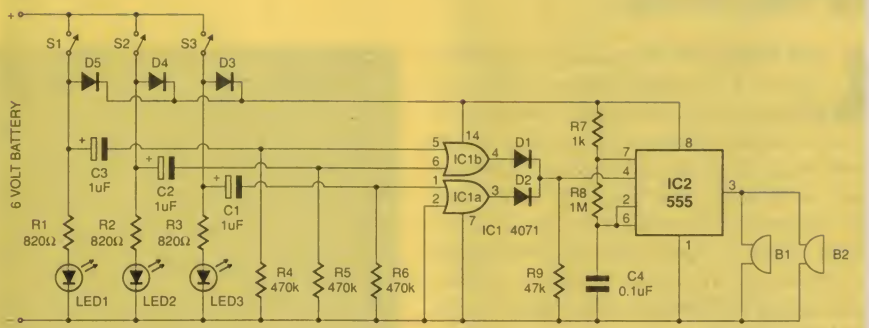
Three reed switches are at the heart of the circuit, one fitted to each door, so as to be open when the door is closed. An appropriately labelled LED lights when its associated door is open. From a fresh battery, each LED only draws 5mA. (With modern LEDs, this could be reduced to 1mA)

The remainder of the circuit is powered via either D3, D4 or D5. However, the 555 is not enabled until pin 4 goes high and this requires that the output of either IC1a or IC1b goes high. In turn, this requires that either pins 5, 6 or 1 go high and this happens whenever a door opens. Because the high on each of those pins is only momentary (i.e. about 1/3 second, whilst C1, C2 or C3 is charging) there is only a short burst of buzzer activity (two brief beeps) at each door opening, after which it goes mute again.

So the beep calls attention to the fact that a door has opened and the LED indicates which door, staying lit until that door is closed. If another door opens before the first door is closed, there is another beep and another LED lights.

The hardest part of the project was to run the wiring from the door switches to the chosen display point (over the boss's desk!). Two beepers were fitted, one at the display point and one in the storeroom, so that it was possible to monitor the shop door, even when checking stock.

Brian Critchley
Elanora Heights, NSW $35



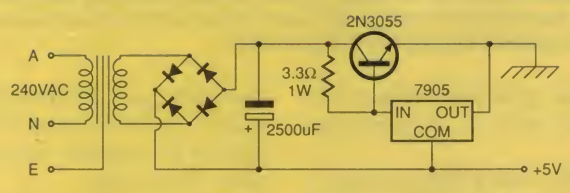
Simple DC supply needs no mounting hardware

The circuit shown is for a positive regulated supply that uses commonly available components. It is a variation of a well known design, but differs in the fact that it uses a negative three-terminal regulator (a 7905) and an NPN pass transistor which is directly chassis mounted. This provides a heatsink, and establishes the ground point of the circuit through the collector's metal case mounting point.

It should be noted that this arrangement precludes an incoming unregulated voltage that has the negative side tied to chassis ground (standard practice) — i.e., a floating input is needed. Minimal current flows through the regulator, and so this need not be heatsinked.

The design is of course adaptable to other voltage levels, by substituting a different voltage regulator (say a 7912 or 7915); all other component values remain unchanged. The incoming unregulated DC supply voltage should be 20-50% higher than the regulated DC output voltage, for efficient operation and ensuring that the circuit can supply the required load.

Frank Hughes
Mount Hawthorn, WA. $35 ❖



Low-cost Clock & Pulse Generator

When you're developing or analysing digital circuits on the bench, there's really no substitute for a versatile clock generator, such as our new design featured here. This inexpensive unit offers a clock rate of 1Hz to 1MHz, and a pulse width range of around 100ns to one second. It also features a fully variable low-impedance output plus a fixed TTL-level output.

by Rob Evans

LIKE MANY OF the projects we produce here at *Electronics Australia*, this new generator was developed in response to several requests from readers, plus a direct need in our own lab. Our existing lab generator is suffering somewhat from many years of continuous use, and is forced to travel from bench to bench following the digital development work and testing — rather demanding treatment, in what appear to be its twilight years.

What we *really* needed was a new clock and pulse generator that offered all of the key features required for this type of work, but in a physical format that was both easy to use and affordable to make yourself. Being an *EA* project it also had to be easy to construct and get going of course, so we set about the task of developing a new generator that would satisfy all of those (often conflicting) criteria.

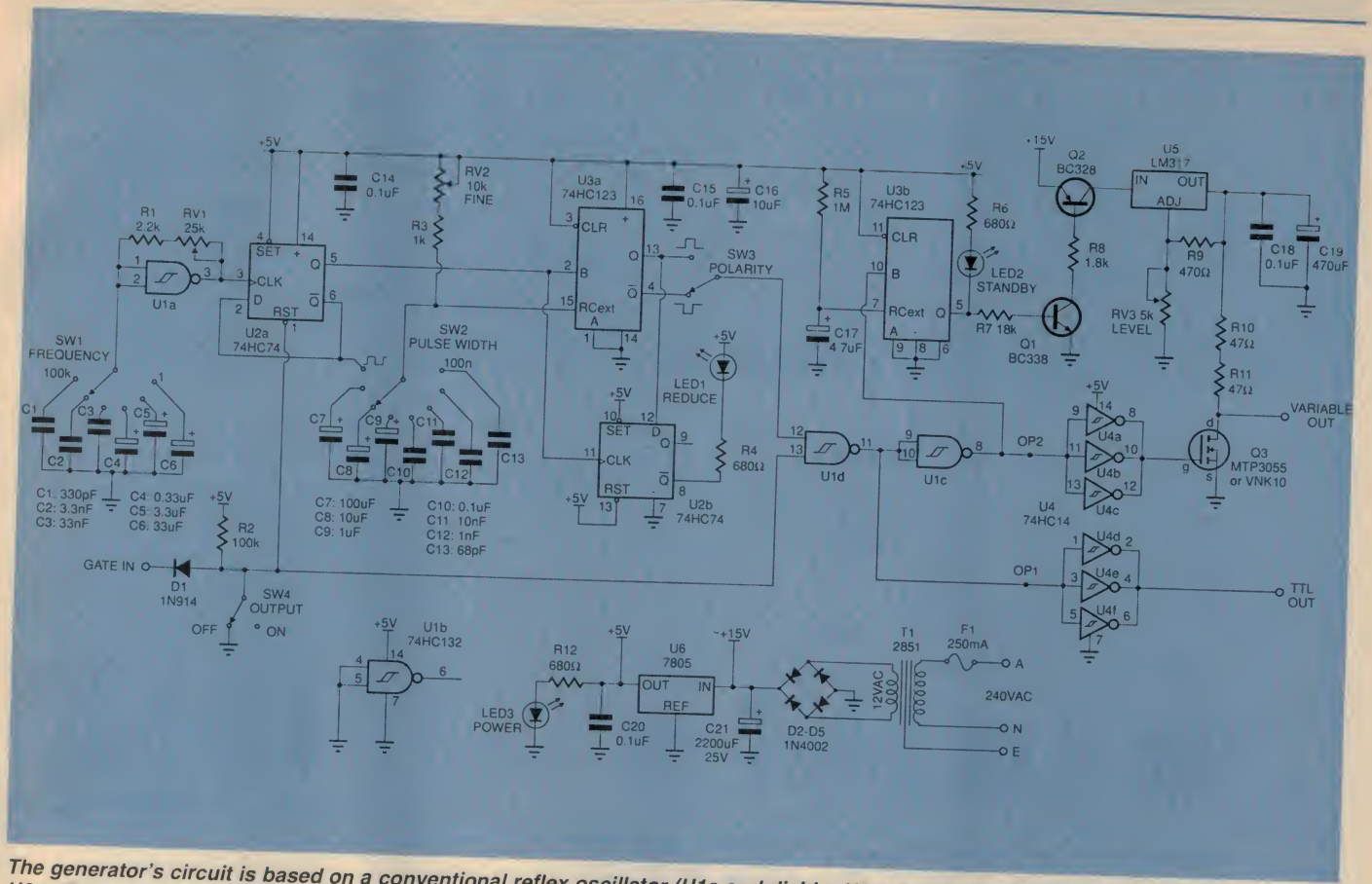
The end result is a design that's loosely based on Jim Rowe's 1MHz pulse generator design from the June 1992 issue of *EA*, but with a number of additional features plus changes to the physical construction. It offers a realistic range of frequencies and pulse widths that will suit the most common tasks, and has a variable output that delivers fast and clean output pulses of up to around 12V peak, with a source impedance of less than 100 ohms.

We've also included a number of useful features such a fixed TTL output, output polarity and on/off switches, a true square-wave option, a power shut-down system to minimise component dissipation, plus a gating input for external control over the generator's output. The gating feature can be used to send a series of pulses from the generator; or since it presents a high impedance, can even be connected to an external circuit's supply rail so the generator automatically shuts down when power is removed from that circuit.

Offering a very practical range of features, our new generator is ideal for digital work on the bench. It's a versatile unit that's very easy to use, and can be built up for a fraction of the cost of an equivalent commercial generator.

Performance-wise, the generator offers a frequency range of 1Hz to 1MHz, variable pulse width from one second down to less than 200ns, plus output rise and fall times of around 30ns when using a MTP3055 output MOSFET, or close to 5ns with the less common VNK10 type.

It's easy to put together too — and when completed, constructors should find both its



The generator's circuit is based on a conventional reflex oscillator (U1a and divider U2a) which drives a monostable pulse generator, U3a. The two outputs are driven via Schmitt inverters (U4), while the variable output stage is formed around switching FET Q3. U3b shuts down the output stage when it's not needed, to reduce the circuit's power dissipation.

performance and range of features easily justifies the modest effort and cost involved. It's already in strong demand around our own lab, and we're happy to report that it's now giving our faithful old lab generator a well-earned rest.

Circuit description

While the generator's schematic may look reasonably involved, the circuit itself can be broken down into two fairly simple sections; the pulse generator itself (U1a, U2a and U3a), plus the remaining output drive circuit and power supply.

Beginning with the generator stage, Schmitt NAND gate U1a is arranged as a simple relaxation oscillator operating at twice the final output frequency, as set by the feedback resistance presented by RV1 and R1, plus the value of capacitance switched to ground by SW1. The components used here allow SW1 to set the frequency in six decade steps, while RV1 will change U1a's overall feedback resistance by a factor of at least 10. This combination allows the oscillator to be set over a nominal range of 2Hz to 2MHz.

The output of the oscillator (pin 3) is then passed directly to a divide-by-two stage formed by U2a, a 4013 D-type flipflop configured in toggle mode (D input tied to the Q-bar output). This reduces the incoming frequency by a factor of two, but more significantly, forces the resulting 1Hz to 1MHz output to have a 1:1 mark-to-space ratio — as needed for the generator's squarewave output option.

Next, the squarewave output from U2a (pin 5) is used to trigger monostable U3a (one section of the 74HC123), which then generates output pulses at a width defined by resistors RV2 and R3, plus the capacitance to ground connected via SW2. As with the oscillator stage, the switched capacitors are arranged for a time variation in decade steps (seven in this case), while the variable resistance leg has a range of 10:1.

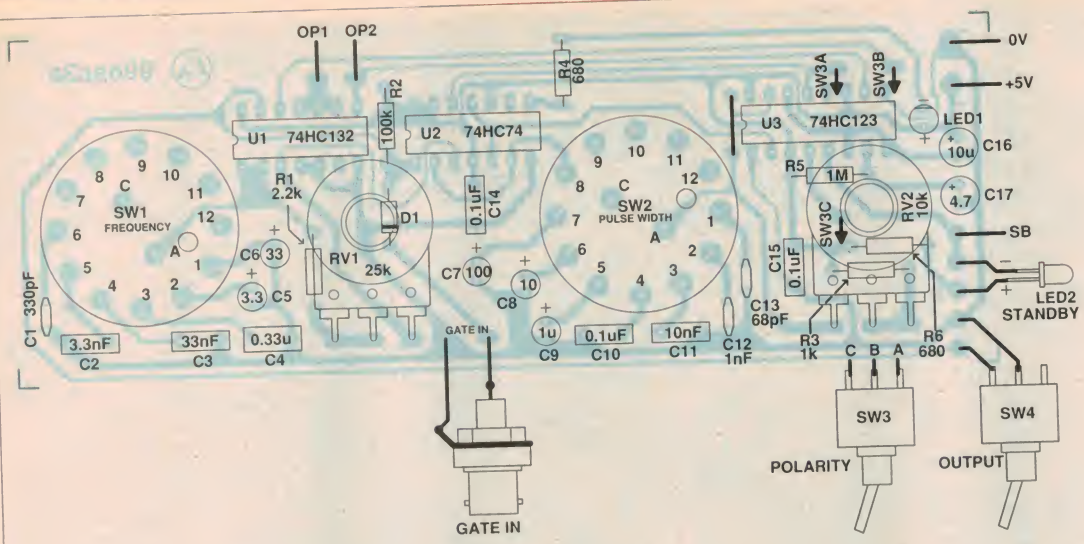
Note however that when SW2 is moved to the squarewave position (SQU on the schematic), the inverted (Q-bar) squarewave signal from U2a is directed to U3a's timing input (pin 15), in place of the normal RC network. This forces the monostable's internal circuitry to reproduce the incoming squarewave signal at its own output, and is a convenient way to select a squarewave output as a pulse width option, when using a single pole switch.

The end result here is the U3a offers a variable pulse width signal over a nominal range of 1.0s to 100ns with a repetition rate of 1Hz to 1MHz, plus the added option of a 1:1 mark-to-space ratio. As U3a has both Q and Q-bar outputs, polarity switch SW3 is then used to select between the normally-high or normally-low pulse streams.

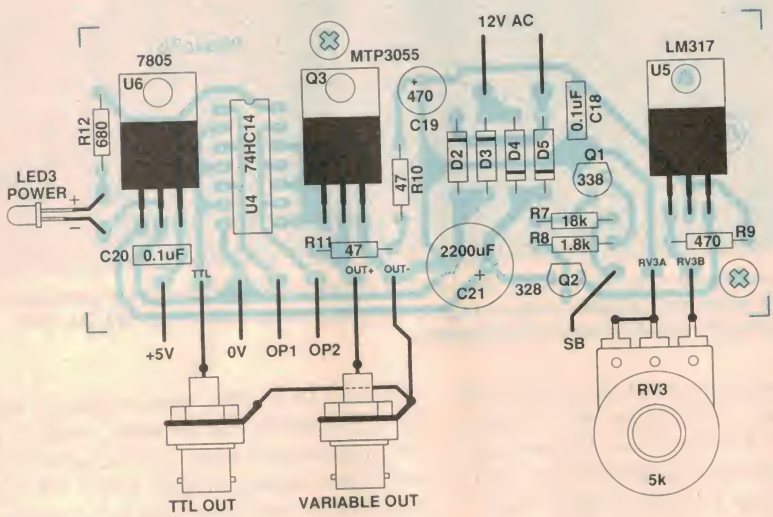
At this point you may have noticed that flipflop U2b has its clock input (pin 11) connected to U3a's trigger input, while its D input is controlled by the monostable's Q output. This means that each time the monostable (U3a) is triggered, the logic level at its output is simultaneously clocked through to the flipflop's output.

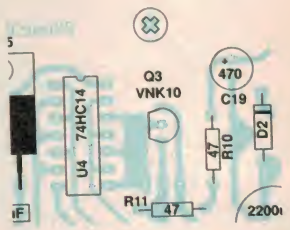
In the normal course of events though, there is a small but significant delay between the time the monostable is triggered and when its Q output goes high. As the flipflop is clocked *before* this delay has elapsed, a low will be clocked though to its output leaving pin 9 low, pin 8 high, and LED1 inactive.

On the other hand, if the monostable has been set for a delay time that exceeds the incoming clock period (an 'invalid' setting), the retriggerable nature of U3a means that its Q output will stay permanently high. This high level will then be clocked into the flipflop (U2b) with each incoming trigger — as described above — forcing its Q-bar output low, thereby activating the 'reduce' indi-



The component overlay diagram for the 'generator' board. RV1, RV2 plus the GATE IN socket mount on short wire stalks, while the remaining off-board components connect via light-duty hookup wire at the copper side of the board.





Use this overlay diagram when assembling the generator's output board. The smaller diagram on the right shows how to install the optional VNK10-type FET, which is smaller and faster than the common MTP3055 used in the prototype.

cator (LED1).

So while flipflop U2b's action isn't immediately obvious from the schematic, the end result is that it instantly activates LED1 when the generator's pulse width is too wide for the current repetition rate, and needs to be reduced — hence the 'REDUCE!' label.

Note that a 74HC221 *non-retriggerable* monostable could have been used as the pulse generator stage instead of the 123-type, and this would continue to produce pulses during an invalid delay setting — say a 10ms pulse at a 100kHz rate. However this would produce confusing results at the generator's output (erratic divisions of the selected frequency), and its state could not be detected by a simple flipflop as in the circuit presented here.

The remaining part of the generator section involves the output gating and on/off control, based on R2, D1 and NAND gate U1d. Ignoring SW4 for the moment, you can see that R2 normally holds both U2a's reset line and the input of U1d high, which enables both stages and allows pulses to pass. Conversely, a low level at the cathode of D1 (GATE IN) will 'disable' both U2a and U1d, forcing the latter's output to a high level.

This in turn holds the unit's TTL output low via the paralleled Schmitt inverters U4d to U4f, while a double inversion path through U1c and inverters U4a to U4c hold MOSFET Q3's gate high. As the MOSFET is biased hard on, the unit's VARIABLE OUT will also be held low during a 'disabled' period.

The output on/off switch SW4 holds the reset control line low when in its OFF position, and therefore disables the generator outputs in the same way.

In its normal enabled mode, the circuit drives both the TTL output and the MOSFET with the generator's pulse train, as set up by the user. The three paralleled gates driving the TTL output provide a fast low-impedance signal suitable for TTL-compatible circuits, while the other three inverters (U4a-c) deliver a clean and fast switching action to the MOSFET gate. Note that the gate offers a high impedance to the driving stage, but also presents significant drain-to-gate (Miller) feedback capacitance.

To provide a variable-level low impedance output from Q3, the MOSFET drain is supplied from an LM317 adjustable voltage regulator (U5) via 47 ohm resistors R10 and R11. The regulator output voltage is set by RV3 (the output level control) in conjunction with R9, and as a result can vary the signal's peak output level at Q3's drain between about 1V and 12V.

Standby mode

While the ability to both gate and shut off the unit's output are useful features, this does bring the potential for excessive power dissipation in the output switching stage and the power transformer itself. As they stand, the output components and transformer are quite

adequate for the unit when its output is on, but the single-ended nature of the output switching stage means that a continuous current will flow when its shut off.

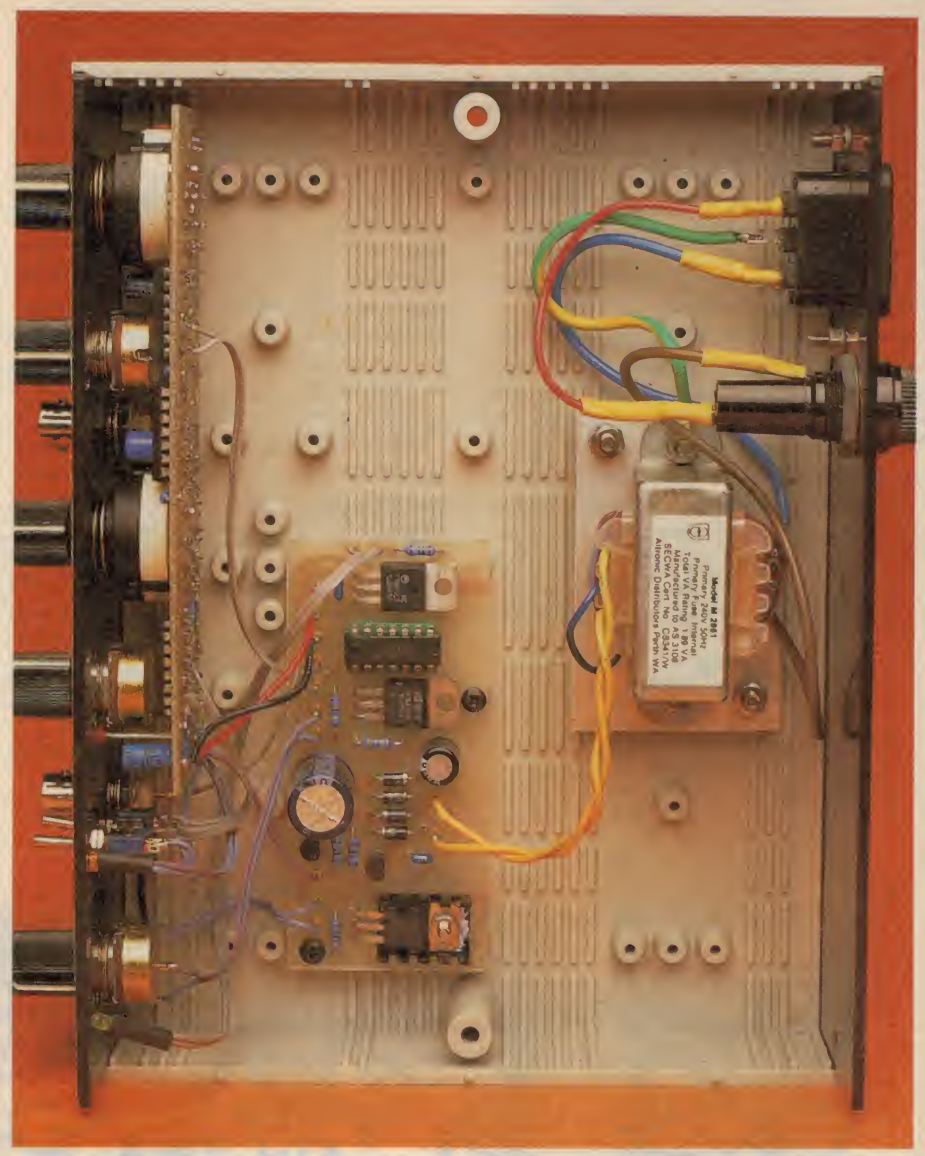
If RV3 is adjusted for an output level of 12V for example, Q3 will continuously draw around 130mA via R10 and R11 when the unit's output is switched (or gated) off. In this case the resistors will get somewhat hot and bothered; but perhaps more importantly, a 150mA power transformer will be running uncomfortably close to its limits.

The crude solution here of course is to use a much larger power transformer and substantially upgrade the resistor power rating. However an inexpensive and more efficient answer to the problem is to simply *shut down* the output stage when it isn't needed, thereby avoiding periods of extended power dissipation. Here, this is done by using the remaining half of the '123 monostable (U3b) to disable the output's voltage source (U5) when the generator's main output signal stops.

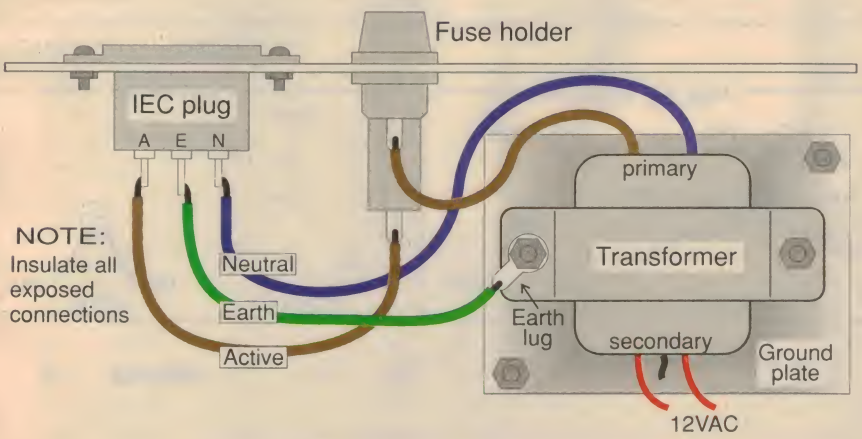
The monostable is continually retriggered by pulses appearing at the output of U1c, which forces its Q output (pin 5) high while the generator is active. This in turn holds transistors Q1 and Q2 on, thereby passing the raw +15V supply to the output stage regulator U5.

However, when the pulses at U1c stop, as the generator is disabled, the monostable will finish its timing cycle after a delay of around five seconds — as set by timing components R5 and C17. The Q output will then fall, LED2 (STANDBY) is activated via R6, and Q1 and Q2 turn off, removing power from U5.

As you'd then expect, the next pulse appearing at U1a will trigger the monostable again, reactivating U5 and the output circuit. In practice this all works quite seamlessly, with the circuit going into its standby mode only when needed, where the overall power consumption drops to a very low level.



Most of the generator's circuitry is held on a single vertical board fitted behind the front panel, while the output stage and power supply sections are located on a small PCB in the bottom of the case. Note the physical arrangement of the 240V wiring, which is also shown in Fig.1 below - the mains wiring diagram.



The remaining part of the circuit involves a conventional power supply arrangement based on a 2851-type power transformer rated at 12V/150mA. The 12V AC secondary voltage is rectified by a full-wave bridge formed by power diodes D2 to D5, while the resulting DC output (nominally 15V) is smoothed by reservoir capacitor C21 then on passed to U6, a 5V three-terminal regulator. The regulator's output is bypassed by C20, and ultimately supplies +5V to the majority of the unit's circuitry, plus the power indicator (LED3) via R12.

Construction

As you can see from the pictures of our prototype unit, the Clock/Pulse Generator easily fits into a standard 200 x 160 x 65mm plastic instrument case, with virtually all of the

circuitry held on two relatively small printed circuit boards.

The signal generator part of the circuit is contained on a 130 x 46mm PCB (coded 99osc3a) which mounts behind the box front panel, via the PC-mount selector switch shafts. This board arrangement eliminates the need for complicated wiring between the rotary switch pins and the PCB, and reduces the amount of stray capacitance in the more critical parts of the circuit.

A relatively small number of interconnecting wires pass from this board to the output stage PCB, which is mounted directly onto the bottom case panel. This one measures 90 x 40mm, is coded 99osc3b, and contains the output drive circuitry and power supply components. The output signals pass from here to BNC connectors on the front panel, which also supports the unit's three 16mm pots and two mini SPDT control switches.

Begin the construction by assembling the generator PCB first, working your way from the small to large components in the usual way. Follow the component overlay closely as you go, and pay particular attention to the orientation of the semiconductors and electrolytic capacitors.

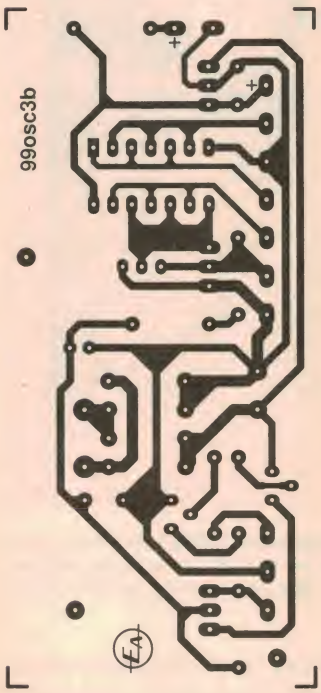
If you're using the four-banded close tolerance resistors, it may pay to check their value with a multimeter as each one is installed, since their colour bands are often difficult to read. Also, note that the two rotary switches must have their adjustable end-stop rings set to the correct position for each switch function — SW1 has six positions (the usual default), but SW2 must be set for eight steps.

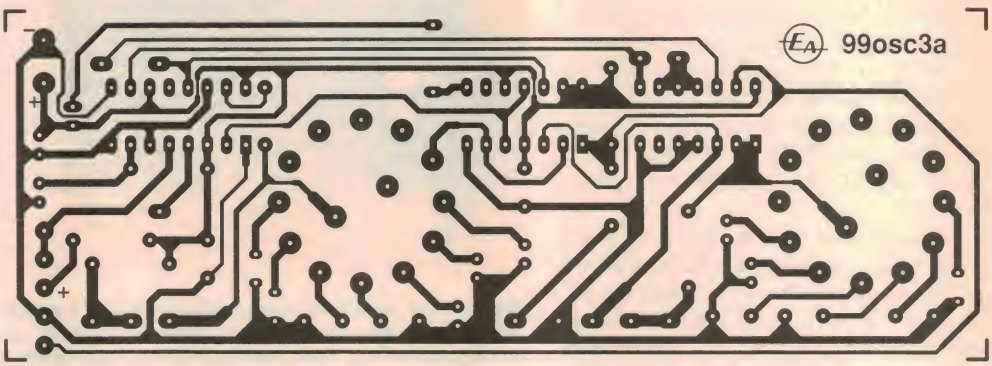
Points to be aware of with the actual board are that RV1 and RV2 end up quite close to the PCB surface, so there may not be enough clearance to use IC sockets with the three chips. Also, the pots and BNC socket (GATE IN) are connected to the board via wire 'stalks' (say, component leg offcuts). These wires are best soldered to the component first, then slid through their matching PCB holes as the board is fitted to the front panel. Once you're happy with the alignment, the wires can be soldered and trimmed at the PCB end.

LED1 can be fitted in the similar manner, by the way, with its leads soldered in place at a point where the lens just pokes through the front panel. The final board mounting arrangement is quite a neat and practical setup, but its one disadvantage is that the board will need be separated from the front panel for serious faultfinding work. This is not too difficult — you just remove the pot and switch locking nuts, then unsolder the BNC connector — but it's a good reason to double check your work before the final assembly steps!

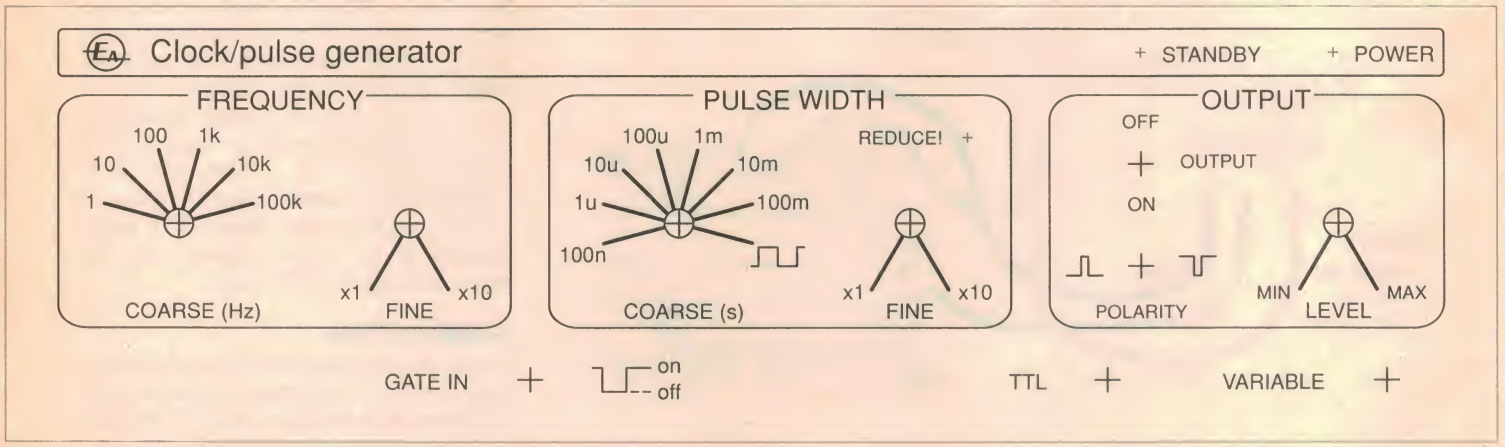
The power supply/output board can now be put together, again while using the component overlay as a guide and taking the usual orientation precautions. Points of note here are that a small heatsink was fitted to the LM317 regulator on our prototype, but thanks to the shutdown feature this is really not necessary under normal conditions. Similarly, we found that the output pullup resistors R10 and R11 only really need to be 0.5W types, but since there's room on the board we've specified the larger 1W variety.

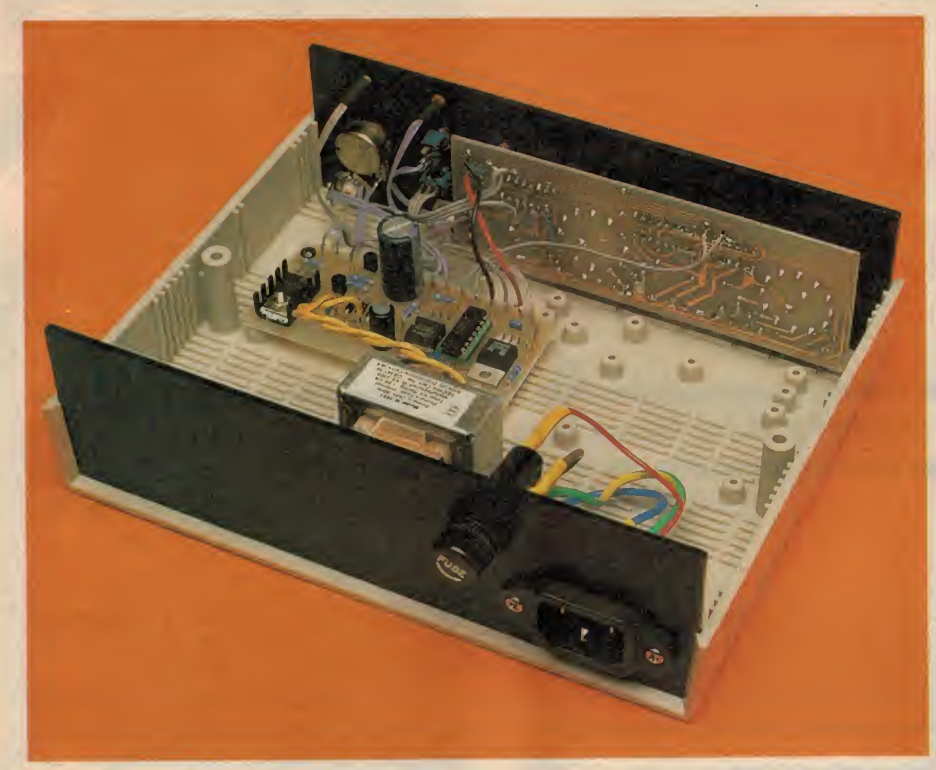
With the two PCBs completed and installed, the remaining components can be fitted to the front panel, and the board interwiring tackled. All of these connections are shown on the component overlay diagrams,





The actual-size PCB patterns for the larger generator board, plus the output/supply board (left). The full-sized reproduction of the front panel artwork (below) can be used to make your own dress panel.





A rear view of the generator's internals, showing the positioning of the two PCBs. Note that while it's not strictly necessary, we added a small heatsink to the LM317 variable regulator (U5) on the output/supply board.

and as you can probably see from the internal shots of the unit we've used PCB pins on the output board, but have wired directly to the PCB pads on the vertical generator board.

Next on the agenda is installing the power transformer, plus its associated mains wiring and components, as shown in Fig.4. In our unit the transformer has been first bolted to an earthing plate, which is in turn attached to the bottom of the case, while the mains earth wire attaches directly to a solder lug on the transformer flange mounting bolt. Make sure that you use locking or star washers on these mounting bolts, for a reliable mechanical and electrical connection.

When wiring up the IEC plug and fuse holder, carefully follow the diagram in Fig.4 while making sure that each connection is well soldered, and joined to the correct terminal. All exposed connections must be fully covered with a suitable insulating sleeving, and when the job's completed, re-check your wiring again...

Initial checks

There are a few basic tests which can be completed on the generator to establish that the main parts of the circuit are functioning as expected. While an oscilloscope would be an advantage here, a multimeter will still yield quite useful results.

Before applying power to the unit, first select 100Hz on the FREQUENCY switch, choose the squarewave option on the PULSE WIDTH control, then wind the OUTPUT pot to minimum and switch the output off. Next, apply power to the unit and check that both the power indicator and standby LEDs are on — if this doesn't occur, quickly turn the unit off, and re-check your work.

If all's well though, the next step is to switch the output on and check that the standby LED goes out. Then advance the output level control, while monitoring the signal at the variable output with a scope or your multimeter (set to AC volts). When the level control reaches its maximum position, you should see a (close to) 100Hz squarewave of at least 10V peak on the scope, or be able to read an AC level of 5V or more on the meter.

If you then switch the output off (or ground the GATE IN connection), the standby LED should come on after a delay of about five seconds. The REDUCE! indicator should also turn on if you move the PULSE WIDTH control to the 100ms position (as this is longer than the period of the 100Hz waveform), but should then turn off when the 100us width is selected — a 'valid' pulse width.

If the Clock/Pulse Generator has passed these initial checks, you can now do a number of more detailed tests, or of course, just put it straight to work on the bench. You should find its range of features both practical and convenient for all manner of testing and digital circuit development. ❖

PARTS LIST

Resistors

R1	2.2k
R2	100k
R3	1k
R4,6,12	680
R5	1M
R7	18k
R8	1.8k
R9	470
R10,11	47 1W
RV1	25k linear pot, 16mm
RV2	10k linear pot, 16mm
RV3	5k linear pot, 16mm

Capacitors

C1	330pF ceramic
C2	3.3nF MKT
C3	33nF MKT
C4	0.33uF electro/tantalum
C5	3.3uF electro/tantalum
C6	33uF 16V electro/tanatalum
C7	100uF 16V electro/tantalum
C8,16	10uF 16V electro/tantalum
C9	1uF 16V electro/tanalum
C10,14,15, 18,20	0.1uF MKT
C11	10nF MKT
C12	1nF MKT
C13	68pF ceramic
C17	4.7uF 16V electro
C19	470uF 25V electro
C21	2200uF 25V electro

Semiconductors

U1	74HC132 quad Schmitt NAND
U2	74HC74 dual D-type flipflop
U3	74HC123 dual retriggerable monostable
U4	74HC14 hex Schmitt inverter
U5	LM317 adjustable voltage regulator
U6	7805 +5V regulator
Q1	BC338 NPN transistor
Q2	BC328 PNP transistor
Q3	MTP3055 or VNK10 switching MOSFET
LED1,2,3	3mm LEDs
D1	1N914 signal diode
D2,3,4,5	1N4002 power diodes

Switches

SW1,2	single-pole sealed rotary
SW3,4	SPDT mini toggle

Miscellaneous

PCBs, coded 99osc3a and 99osc3b; plastic instrument case, 200 x 160 x 65mm; 12.6V/150mA 2851-type mains transformer; five plastic knobs; panel-mount IEC mains plug; panel-mount fuse holder, with 250mA fuse; three panel-mount BNC sockets; solder lug; PCB pins; hookup wire; transformer mounting plate; heatshrink or cambric tubing; nuts, bolts, lockwashers, etc.

Cybug turns into a Predator!

If you'd like to continue experimenting with the Cybug robot insect kit, here's how the low cost HBF-2 add-on kit can be used to convert a pair of Cybugs into a Predator and its Prey. As before, it's good fun as well as giving you insights into current thinking about the neural behaviour of insects.

by Jim Rowe

ENCOURAGED BY the initial response to their Cybug 'robot insect' kit, as described last month, Dick Smith Electronics has decided to make the matching HBF-2 'Predator and Prey' add-on conversion kit available as well. You might recall that Cybug has been designed by Canadian electronics teacher and robotics enthusiast Craig Maynard, with the idea of producing a low cost and really easy to build project which would give valuable insights into current thinking about the neural behaviour of real-world insects.

Despite its simplicity the basic Cybug has simple light-sensing neurons, plus 'feelers' which allow it to sense and avoid obstructions. It also has a pair of motors to make it mobile, and the sensory inputs can be configured so that it becomes either light-avoiding (photophobic) or light-seeking (phototropic). Either way, it behaves in a surprisingly similar manner to a cockroach, earwig or other simple 'crawlie'.

Aware that constructors might soon get a little bored with this basic behaviour, though, designer Craig Maynard has also come up with a couple of 'higher brain function' (HBF) add-on modules, which can be used to change Cybug's behaviour in different ways.

The HBF-2 module is called Predator and Prey, and is basically two small PCB assemblies — one of which is used to convert a Cybug into a 'Prey', and the other to convert another Cybug into a 'Predator' which will pursue the Prey as soon as it becomes aware of its presence nearby. A couple of Cybugs converted using the HBF-2 kit therefore tend to behave in a manner quite like a spider pursuing an earwig, or some other innocent beast...

The HBF-2 modules operate by using infra-red (IR) radiation as a kind of synthetic 'smell' emitted by the Prey, and sensed by the Predator. The PCB assembly added to the Prey causes it to radiate IR from its 'rear end', when it's active, while the assembly added to the Predator includes two IR detectors which give it a greatly enhanced ability to detect IR, and head towards its source. The rest is just 'nature taking its course'.

How they work

As you can see from the schematics in Fig.1, the add-on Prey circuitry is simply a 555 timer chip (IC4) connected as a free-running oscillator running at about 40kHz, and driving IR LED D2. As a result D2 produces a constant stream of IR pulses, whenever the Cybug it's fitted to is activated.

IC4 is connected in fairly conventional fashion as an astable oscillator, with components R5, R6 and C3 determining its frequency. With the values shown the frequency will generally be very close to 40kHz, but the PCB allows R6 to be replaced with a 10k trimpot if you want to adjust the frequency in order to optimise the response from the

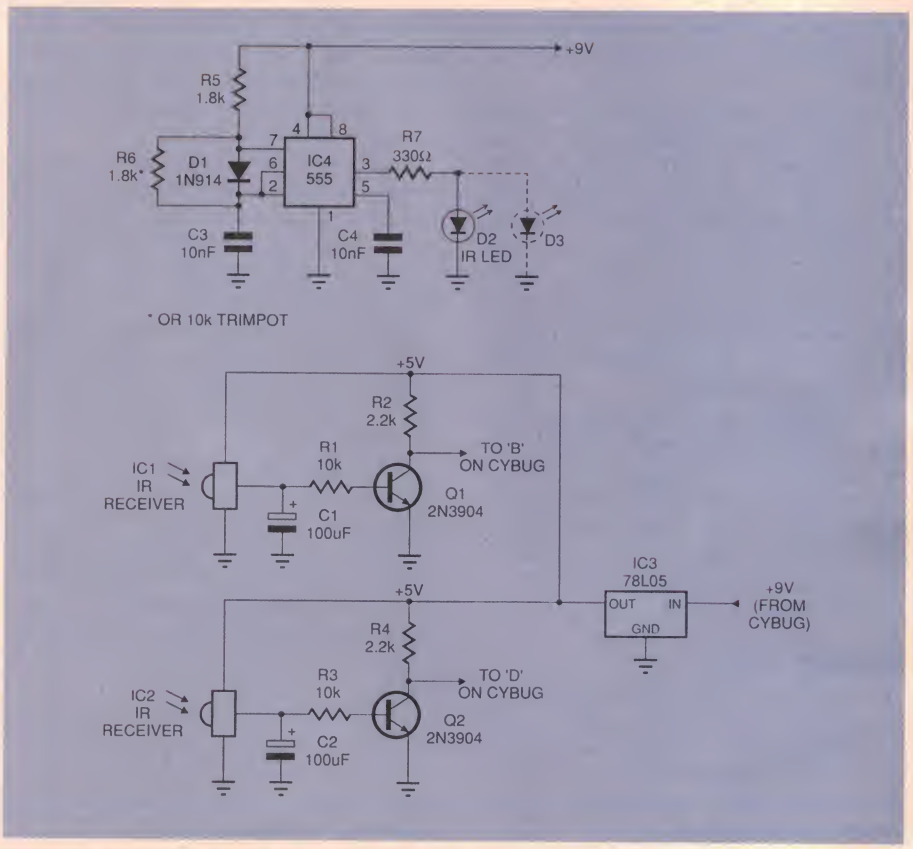


Fig.1: Schematics for the Prey (top) and Predator (bottom) add-on circuits. As you can see they're quite straightforward.

Predator. Usually this isn't necessary.

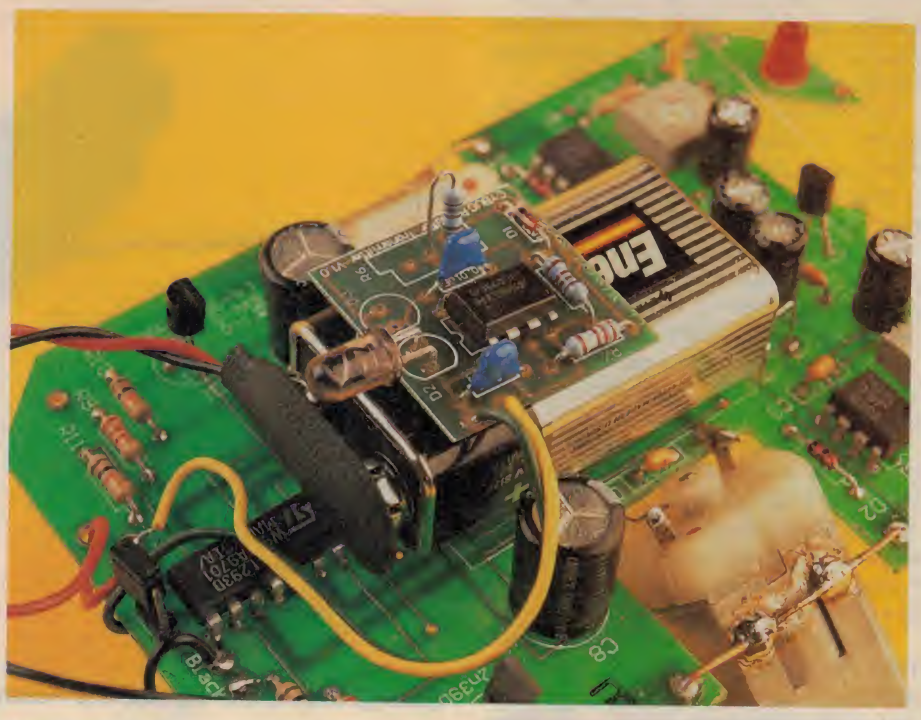
As you can see, IC4 drives LED D2 via resistor R7, which limits the LED current to around 30mA peak. The PCB also allows for the addition of a second IR LED if you wish (D3), to provide additional 'scent'. If D3 is added R7 can be reduced in value to provide extra current — but this will tend to flatten the Prey Cybug's battery rather faster. Actually a single IR LED seems to give quite satisfactory performance; the second doesn't seem to be necessary.

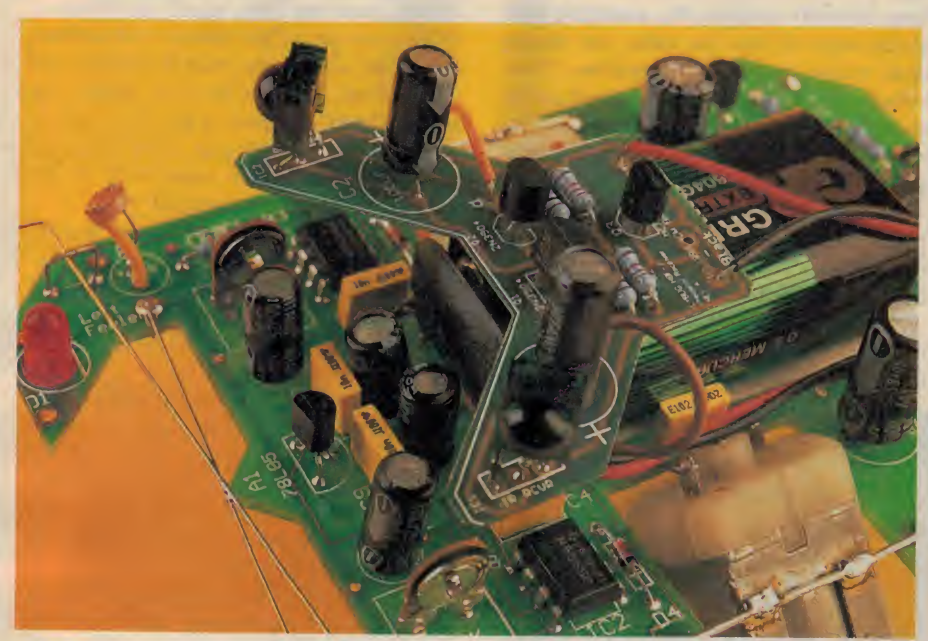
The add-on Predator circuitry is almost as simple, as you can see. Two IR detector chips (IC1, IC2) are used to sense the nearby presence of an IR emitter, and take over as the Predator Cybug's 'eyes' — now especially sensitive to IR radiation. The output pin of either IC1 or IC2 (or both) falls low whenever the device detects IR radiation pulsing at around 40kHz.

The outputs of the IR detectors are connected via series 10k resistors to the bases of inverter transistors Q1 and Q2, as shown. In the absence of radiation, the outputs of the detectors rise to around +2V (with this loading), biasing the transistors into conduction. Their collector voltages are therefore low, and as you can see these are connected to pins 'B' and 'D' on the main Cybug boards, in place of the original links J1 and J2. This means that Q1 and Q2 now provide the pulses fed to the Enable inputs of each of the Cybug's motor drivers.

So as soon as either IC1 or IC2 detects IR radiation from the 'Prey', its output voltage drops — removing the forward bias from either Q1 or Q2 (or both). The rising voltage at the transistor collector(s) therefore enables Cybug's motor driver(s), and Cybug moves towards the source of radiation (or straight ahead, if both detectors have sensed radiation).

It's pretty straightforward, as you can see. Capacitors C1 and C2 provide filtering of the detected signals, and give the Predator's IR sensing a 'fast attack, slow recovery' characteristic for more realistic operation. Voltage regulator IC3 breaks down the +9V from Cybug's battery and provides a regulated +5V source for the detector ICs and inverter transistors.





Above shows the way the Prey PCB is attached to the top of its Cybug's battery, with the IR emitting LED facing backwards. Below you can see the Predator PCB mounted in similar fashion on its Cybug, but with the IR sensors towards the front.

Construction

Both the Predator and Prey modules are built on very small PCBs, which mount onto existing Cybugs in 'piggyback' fashion. They're so small and light that they can be supported using double-sided adhesive tape, on the top of the batteries. The Prey PCB assembly is small and almost square, and mounts with its IR emitting LED directed towards the rear of its Cybug, while the Predator assembly is roughly 'Y' shaped and faces towards the front.

Hopefully you can see the parts layout on each PCB from the close-up photos, and the way they're mounted on each Cybug from the other photos. Each PCB is silk screened to show the location and orientation of the components, so you shouldn't have any problems if you use the boards themselves and our photos as a guide.

As usual, it's easiest if you fit the low-profile resistors and diode (D1) first, taking care to fit D1 the correct way around. Then fit the small capacitors and electrolytics, again taking care with the polarity of C1 and C2. Finally you can add the ICs, the IR LED (D2), the transistors and the IR detectors (IC1, IC2).

Make sure you don't confuse IC3 with the two transistors — they're all in TO-92 plastic packages. If necessary use a magnifying glass to identify IC3 from its markings, and fit it to the Predator PCB first to avoid mistakes.

The two IR detectors are mounted at the front ends of the 'Y' arms of the Predator board, as you can see, but with the leads cranked so that the lenses are directed roughly in line with the arm axes. This means that when

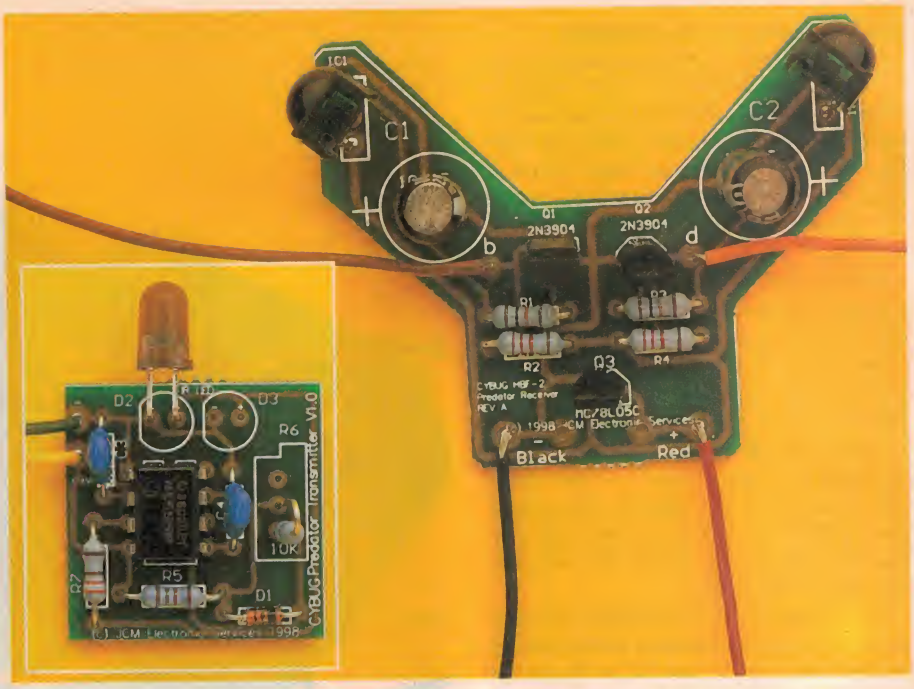
the PCB assembly is fitted to the top of the Predator Cybug, its new IR 'eyes' are looking forward but also outwards, at about 45°.

To complete each board assembly, fit lengths of colour-coded insulated hookup wire to each, ready to make its connections to their respective Cybug main board. The Prey board has only a pair of wires, for the +9V and negative rail supply lines, while the Predator board has both +9V and negative wires (pads labelled + and -) plus the two output signal lines (pads labelled 'B' and 'D'). Each of these wires should be about 100mm long initially; the excess can be trimmed off later.

When this is completed the Prey board can be fitted to the top of its Cybug's battery using a piece of double-sided adhesive tape, with the IR LED pointing directly backward. Its power wires can then be connected to the Cybug supply, but there's an important point to watch here.

The original instructions supplied with the HBF-2 kit suggest that the wires are simply soldered to the 'Red' and 'Black' pads at the rear of the Cybug main board — the same pads used to terminate the wires from the battery. However if you do this, for example with the wires from the add-on Prey board, it will clearly be connected directly across the battery even when the Cybug's power control link is removed. This would be an excellent way to make sure you flatten batteries at the highest possible rate!

The sensible approach is therefore to connect the wires so that the supply to the add-on board is again controlled by the jumper link, as with the Cybug itself. You can do this by connecting the positive (red) wire to the positive ('Red') pad on the rear of the Cybug, but the *negative* (black) wire to the switched negative rail on the underside of Cybug — i.e., one of the solder pads underneath the control link pins, and in fact the one at the end of the thick track running down under the centre of motor control chip IC3 (and connecting to its pins 4, 5, 12 and 13).



Close-up views of the Prey (left) and Predator PCBs, to guide you in wiring them up.

A similar approach is taken with the Predator PCB, when you fit it to its own Cybug. Here I suggest you first cut the 'B' and 'C' signal output wires to about 60mm long, carefully stripping the insulation from about 4mm of their far ends, and tinning them ready to make a connection. Then, before you actually mount the board on the top of the Cybug battery, you can cut the original J1 and J2 links on the Cybug (just in front of the battery), and solder the two new wires to the ends of the cut links nearest the battery. As these joints end up directly under the add-on PCB, they're much easier to make before the board is mounted.

Note, though, that these signal wires from the Predator PCB 'cross sides' in hooking up to the Cybug. The wire from the right-hand side of the add-on board goes to the left-hand link on the Cybug, and vice-versa. If you don't do this, your Predator Cybug will behave *very* strangely...

With the two signal wires soldered to the Cybug, you can then attach the Predator PCB to the top of the battery with double-sided tape, and finally make the power wire connections. As with the Prey board, the positive (red) wire goes to the 'Red' pad on the top of the Cybug's rear, while the negative (black) wire goes underneath to the switched side of the control link pins.

Your pair of Cybugs should now be happily converted into a Predator and its Prey, so if you power them up and set them loose on the kitchen floor, they should immediately begin demonstrating one of the harsh facts of insect life.

Note that with the Predator PCB fitted, preset pots R4 and R8 on that Cybug no longer control its mobility; they now control only the flashing rate of its LEDs. In fact the Predator now responds only to its new IR sensors, and will lie dormant until its sensors detect the presence of the Prey Cybug.

If you find that the Predator doesn't seem too 'interested' in chasing after the Prey, even when it ventures nearby, your Prey's IR emitting 'lure' may be flashing at a rate just outside the sensitive range of the Predator's IR sensors. The solution here is to replace resistor R6 on the Prey's add-on PCB with a 10k preset pot, which will allow you to 'tune' its modulation frequency for a better response. Simply adjust the pot until the Predator suddenly finds the rear end of the Prey much more attractive! ❖

Parts List

'Prey' PCB:

Resistors
(All 1/4W, 5%)

R5,6	1.8k
R7	330 ohms

Capacitors

C3,4	10nF monolythic or MKT

Semiconductors

D1	1N914 or similar diode
D2(D3)	IR emitting LED
IC4	555 timer IC

Miscellaneous
PCB, 25.4 x 25.4mm; two 75-100mm lengths of insulated hookup wire; piece of double-sided adhesive tape; solder etc.

'Predator' PCB:

Resistors
(All 1/4W, 5%)

R1,3	10k
R2,4	2.2k

Capacitors

C1,2	100uF 6VW RB electrolytic

Semiconductors

Q1,2	2N3904 NPN silicon
IC1,2	IR sensor IC, 38kHz centre frequency
IC3	78L05 low power +5V regulator

Miscellaneous
PCB, 50.8 x 40mm approx (Y-shaped); four 100mm lengths of insulated hookup wire; piece of double-sided adhesive tape; solder etc.

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Moffat's Madhouse

Y2K December Fool?

LET ME RELATE a story to you:

A Seattle man, fearful of the Y2K computer bug, tested his home appliances, and most were fine. But his wristwatch was not. He set it for Tuesday, January 4, 2000. The embedded firmware was not programmed to run after 12/12/99. The watch believed there was no Tuesday that related to 4/1/00, so it promptly exploded, blowing the man's arm off.

Another story: *Since their engines contain computers, 25% of modern fire engines will fail to start on January 1, 2000. By implication, this extends to all vehicles containing internal combustion engines made since 1985. What a way to end traffic jams, eh?*

This may read like a typical Moffat's Madhouse April Fool's story, but it ain't. I must admit I made up the first yarn, or at least the part about blowing his arm off. The rest came from the local newspaper. I just embellished it a bit. As for the fire engines, that is only one of the many Y2K computer-bug stories making the rounds here, striking fear into the hearts of those who expect the end of civilization as we know it.

FEAR is a major industry in the USA. We are bombarded with television commercials plugging this or that medicine which we MUST take, on fear of death. Our homes MUST have bars on their windows and extensive electronic alarm systems, otherwise we will be murdered in our own beds. Of course, if we order the right product, spend the right money, we are once again safe.

Into this climate comes the fear that the world is going to end at midnight on December 31, 1999 because computers can't handle 2000. Various computer 'experts' tell us that airplanes filled with passengers will fall from the sky. There will be no water, no food, no electricity, no telephones, because all these services depend on the **microprocessor** which, unable to keep the correct time, will crash in confusion.

Banks will be unable to operate and will go broke, because their computers will think it's the wrong date. People's life savings will disappear overnight, and the world will be plunged into a depression unlike anything ever seen. Rampaging mobs will rule the streets, fighting each other over the scraps of food that remain after the Y2K bug brings down the world's computers.

Smart people will abandon the cities well in advance of the year 2000. They'll set up isolated homes in the bush, arm themselves with powerful weapons, and stash away a year's supply of food. They'll take their money out of banks, and use it to buy gold, the only wealth that will survive in the year 2000.

Much of this information is being circulated by people such as Dr Gary North, a frequent speaker on the subject: "At 12 midnight on January 1, 2000, most of the world's mainframe computers will either shut down or begin spewing out bad data. Most of the world's desktop computers will also start spewing out bad data. Tens of millions — possibly hundreds of millions — of pre-programmed computer chips will begin to shut down the systems they automatically control."

The owner of Tom's local video shop doesn't really expect her old XT computers to explode in a cloud of sparks, but she's prepared!

"This will create a nightmare for every area of life, in every region of the industrialized world. Think of what happens if the following areas go down and stay down for months or even years: banks, railroads, public utilities, telephone lines, military communications, and financial markets. What about Social Security and Medicare? If Social Security and Medicare go down, it will affect millions of people. Yet both programs are at risk."

Dr North then goes on to point out that these hazards might be relieved if one acquires the book he sells, called *Time Bomb 2000*. You can also learn about Y2K preparedness with books such as the *Xephon Special Report*, priced at US$265. That's $1.76 per page!

There are commercials running on American radio, urging listeners to convert their cash to gold. The advertiser, of course, is quite willing to sell you the gold. And at the end of the commercial, Dr Gary North's name is invoked to convince you to buy the gold, or else!

Other radio commercials offer you the once-in-a-lifetime chance to buy a year's supply of food, all packaged and ready to hide away. You'd better act quick, though, because supplies are limited and you may miss out! I also heard an interview recently, on American radio, with a guy who moved his family from Melbourne to the bush near Ballarat, to escape the chaos that will come in the year 2000.

One can, of course, be free of Y2K worries if you hire a consultant to go through your computers and excise the bugs. This handy business is making a *lot* of money for a lot of people. The technology magazine *C-NET* has stated, "Fortunes will be made by companies that specialize in fixing the millennium bug". There is also a section called 'Jobs 2000', which opens with: "Welcome to Jobs 2000, the labour exchange devoted exclusively to the burgeoning Y2K industry."

Now consider this: A company hires a high-priced consultant who spends hundreds of hours poking around in its computers. Finally the consultant announces that the computers are 'Year 2000 compliant' so there is no longer anything to worry about. Eventually 2000 arrives, and the computers work fine. The consultant is a hero. But maybe, just maybe, there was nothing wrong with them in the first place.

This whole Y2K business sounds strangely familiar. You may remember back in 1991 there was a deadly computer virus called 'Michaelangelo'. It was supposed to zap more than five million computers on March 6, Michaelangelo's birthday. But companies that market virus scanners came to the rescue with plenty of antivirus software, which terrified computer users snapped up with considerable enthusiasm.

by Tom Moffat

Guess what happened on March 6? Very little. There were at most 10,000 computer failures throughout the world. But then again, 10,000 out of five million computers could be expected to fail on any given day, virus or no virus. Was Michaelangelo a false alarm? A 'managed' scare story?

Well, it's now time to stick my neck out. I sometimes work as a for-hire PC guru, helping people through hardware and software woes. I run a little Y2K test program on every computer I visit, and my experience suggests one thing: **for PC's at least, most of the fears are a load of hooey**.

I suspect that saying such a thing will bring calls to *Electronics Australia* demanding my immediate dismissal. That's fine, if the management will just wait until the year 2000 arrives. If I'm right, they can give me a nice pat on the back. If I'm wrong... well, my job won't be good for much anyhow, if the world ends.

Dr Gary North says 'most' of the world's desktops will fail, matching his warning about mainframes. But I have doubts about this, and a look at the technology involved in the IBM-PC should illustrate why:

Around the time that the IBM-AT computer family appeared, Motorola introduced a chip called the MC146818. This is generally known as the computer's 'CMOS', and it's the place where configuration data about things like hardware ports and disk drives are stored. The user can manipulate the contents of the CMOS by hitting a key combination such as Control-Escape or F2 during boot-up. This brings up a CMOS screen where you can make changes. (Be careful here, you can also make an awful mess!)

Every PC computer from the AT on up through the Pentium series contains an MC146818, or something that emulates its functions. The chip can be accessed through two I/O ports, at addresses 70 and 71 (in hexidecimal). There are 64 registers in the chip. Port 70 is an index register to select which of the 64 data registers you wish to access. Port 71 is where you exchange data with the register you selected via port 70.

CMOS memory draws very little power, so the MC146818's data can be held in place by a small battery, usually a button cell, which lasts for several years. You'll know the CMOS battery is going flat when the computer's clock starts losing time, because...

The MC146818 also contains the computer's system clock, and an alarm. The first register, number 00, contains the clock seconds, then comes 01 containing the seconds the alarm is set to. Register 02 contains the minutes, and 03 the alarm minutes. And so it goes, in easy-to-read BCD format, right up to the clock year and the alarm year. And after that comes the CMOS data for the computer's configuration.

But what about the century? If you can't store the next century the clock won't run past 1999, right? Perhaps this is what has inspired many people to assume that these computers will go haywire when we hit 2000. But, the century IS there, way up at register 32 (hex — i.e., 50 in decimal). If you look there (this year) you will find the number 19 displayed in BCD.

"... for PC's at least, most of the fears are a load of hooey!"

The clock values are arranged so each one carries over into the next; that is, after 59 seconds the minutes increments by one, and so on. The MC146818 does NOT increment the century; the register is only there for storage.

The CMOS clock is controlled by the computer's BIOS chip. There is a special BIOS function, 1A (hex) which lets you set the time, read the time, set the alarm, and read the alarm. Recent BIOS chips update the MC146818's century byte whenever the BIOS date/time functions are accessed. Whenever the year byte is between 50 and 99, the number 19 is loaded into the century byte. if the year is between 00 and 49, 20 is loaded into the century byte. So the the MC146818 is good for another 50 years, with the help of the BIOS.

There is a third level of time-of-day keeping, through MS-DOS. This consists of a series of registers in the computer's main memory which contain their own version of the date/time. These are normally loaded by the BIOS routine when DOS starts. If the load doesn't occur, the DOS clock starts counting from January 1, 1980, the date of birth of the IBM-PC.

Conclusion: With all these things going for it, most PC's will follow the change of millennium. Those that don't increment automatically can be nudged by hand, after which they should keep good time for the next thousand years.

As for the older IBM-XT line of computers, they didn't have a CMOS chip, only some DIP switches to set up computer hardware parameters. Therefore there was no real system clock, only those DOS registers that count from 1980. So with the XT it was necessary to type in the date and time every time the computer was started.

This was a tedious business, until the introduction of an add-on battery-powered clock chip. These usually came as some kind of module that sat on top of the 8086 processor and shared its pin connections to the computer's busses. As I remember, these chips don't store the century.

So at last we find a computer which is probably Y-2-Kaput. No longer used? Not quite. My car insurance company still has XT's in every office ("If it ain't broke, don't fix it"), but they will most likely have to do some upgrading before the fatal millennium moment.

There are two XT's running the inventory system at the video shop I use. The owner seems non-Y2K-frightened, but I may word her up as the deadly day approaches. If she still ignores Y2K, perhaps I shall arrange to spend New Years Eve in this video shop, to watch two XT's explode in a shower of sparks. (Only joking!)

Another Y-2-Koncern involves preprogrammed chips in things like car computers, traffic lights, and the like. Many of these are off-the-shelf components, with clock functions in case someone has a need for them. But I have yet to figure out why my elderly Volvo station should care what the century is, or even what time it is. Yet 'experts' say there's a one in four chance it will stop running next January 1. Harrumph!

Software may be a concern, but makers like Microsoft are fixing up any suspect programs so they'll handle the 21st century without a hitch. Visual Basic is one that's causing some concern at the moment.

Meantime, an enormous amount of money is being spent on Y2K. In the town where I live, Y2K preparedness is the biggest local government budget item for 1999. The State of Washington has decided that the National Guard (Army reserves) will be on duty New Years Eve, to quell the rioting and looting that are certain to occur. Is this overblown, or what? Friends of mine in Australia and Europe snort with derision about the Yanks and their Y2K madness. Who's right?

There are a couple of programs for you to download from Electronics Australia's web site, contained in the file MAD2000.ZIP. VIEWCMOS.EXE lets you watch your computer's MC146818 CMOS chip in real time. It constantly ticks over the seconds in register 00, along with the other clock values. You should notice the number 19 in register 50. All three PC clocks are also seen running. The other program is 2000.EXE, the Y2K test program I've been using on clients' computers. Try it on yours — and thumb your nose at Y2K...

There's also a PDF file (PREP.PDF), which is a handout from Project Cassandra, giving their official advice on how to survive Y2K. It's the best single source I've seen yet, of the advice the doomsayers are promulgating. Read it and weep (laughing)! ❖

$10 Wonders

22 — The Reminder

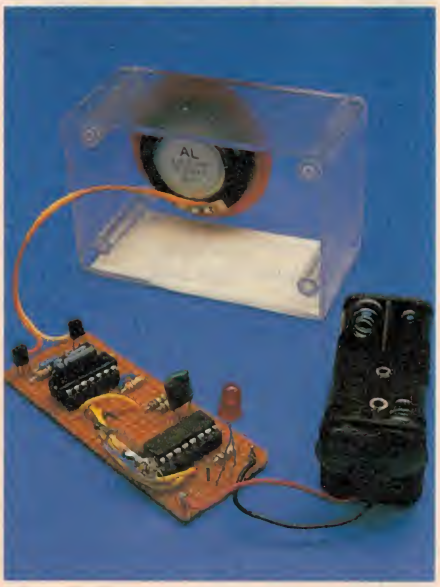
"Oh Bother! Sorry, I forgot all about it..." If you find yourself saying this more often than you'd like, then this is the project for you. The Reminder is a device that nags you once every minute or so to make sure that you don't forget to go to that appointment, make a phone call, turn off the sprinkler or whatever.

The project consists of a small plastic box containing a battery-powered circuit that emits a brief burst of beeps around once every minute. The beeps do not last long enough to be a nuisance, but they are insistent enough to prevent you from forgetting that there is something to remember. We first thought up this idea when reading e-mail. Excitedly perusing the latest mail in the In Box, we forgot to log off and thereby incurred unnecessarily large charges from our ISP.

Now we remember to switch off in good time, because the circuit not only produces regular beeps but it also flashes an attention-getting LED all the time. It also reminds us when we have the hose on, topping up the fishpond in the garden.

If you want to leave a message for someone or even a reminder for yourself, there is a write-on panel on one side of the box, where you can write a note in pencil or wash-off felt tip pen. The flashing LED and the beeps will ensure that the message is not ignored.

How do you stop the beeps and flashing when the message has been read, or when the fish pond is full? Just turn the box upside down. The project has a mercury switch inside it, so the circuit runs only when the box is placed the right way up.



The Reminder is a simple project that will subtly remind you every minute with a beep and flashing LED. It is shown here out of its plastic case so that you can see the circuit board and speaker mounting.

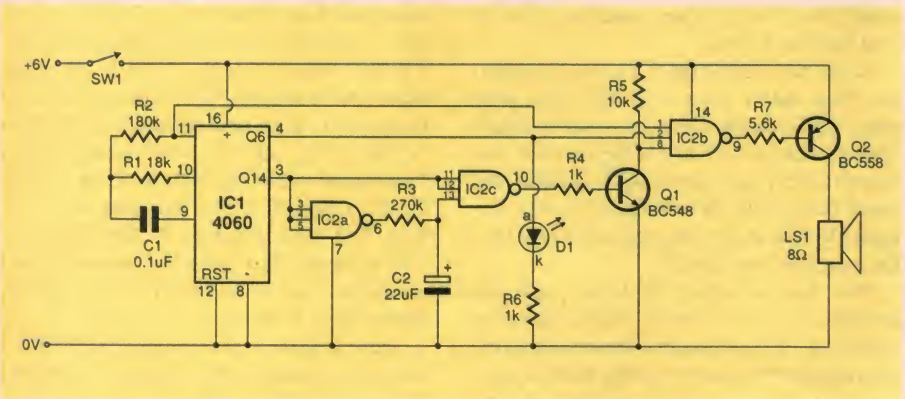


Fig.1: IC1 is a self oscillating binary counter with IC2 decoding its outputs to give a burst of four beeps once a minute. SW1 is a mercury switch that turns off the Reminder if turned upside down.

How it works

The circuit is based around an oscillator running at about 250Hz. In Fig.1 the timing capacitor and resistor are C1 and R1, and their values set the frequency of the oscillator. The oscillator circuit is contained within IC1, which also contains a 14-stage binary divider. The output from the sixth stage (pin 4) runs at 250Hz divided by 64. That is to say, it runs at just under 4Hz, rapidly flashing the LED, D1.

A separate longer time period is obtained from the output of the 14th stage (pin 3). Here we have 250Hz divided by 16,384, or 0.015Hz. Putting it another way, the output at pin 3 has a period of 65 seconds. A pair of NAND gates is connected to these outputs, forming a simple pulse generator.

To explain the operation of the pulse generator, we'll assume that the output from the binary counter (IC1) is low and that the capacitor C2 is fully charged. After 32 seconds, the counter's output goes high, and the output of IC2a instantly swings low, but the charged capacitor prevents the input to IC2c from falling immediately. At this point, both inputs to IC2c are high, so its output goes low, and stays low until the capacitor has discharged through R3 to a point where the input to IC2c falls below 3V. With the values shown, this takes around four seconds.

32 seconds after its first transition, the counter's output swings low again, but this doesn't affect our pulse generator circuit. IC2c's inputs are now both low, and so its output stays high. When the capacitor has charged again, the output remains high.

Summing up, the output of the generator (pin 10 of IC2c) is normally high but goes low for four seconds every 65 seconds when the counter's output swings from low to high. (Essentially it's a rising-edge triggered monostable.) The generator's output drives a transistor Q1 wired as an inverter, so the input at pin 8 of gate IC2b

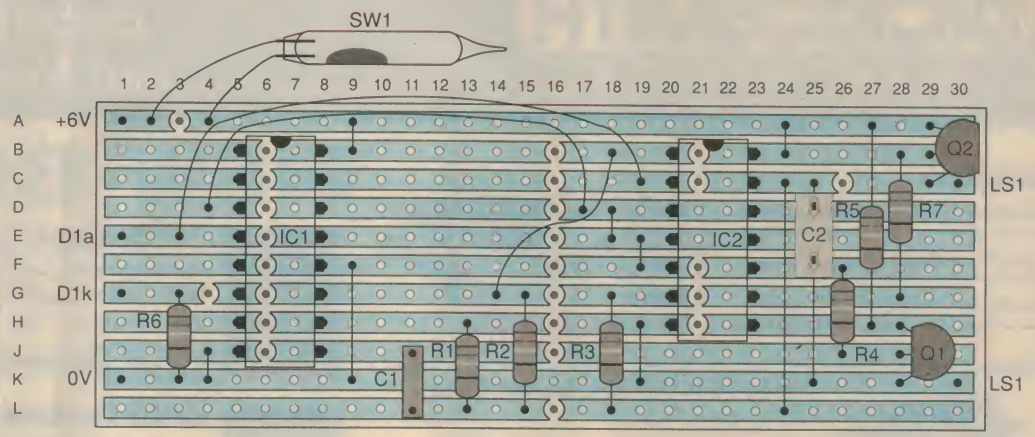


Fig.2: F ow this overlay d hen building the R and note that t and E21 are not c ote that Q1 and C erent types of t so be sure not t mixed up.

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apidly on and off at 4Hz to pro-
s. The PNP transistor Q2 is used
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ormally high and goes low only
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your preferences. The frequen-
ıe oscillator is given by **f**
C), where R = R1 and C = C1.
about 10 times R1. Adjusting
ıes allows you to alter the pitch
nd, but it will also alter the peri-
n sounds. If you want a shorter
ou could take the output from
pin 2, 32.5 seconds) or stage 12
seconds).
ly you can get a faster beep rate
he output from stage 5 (pin 5) or a slower rate from stage 7 (pin 6). The length of the pulse is approximately **0.7RC**, where R = R3 and C = C2. Varying these values lets you have a shorter or longer burst of beeping.

The power switch for the circuit is a mercury tilt-switch, positioned on the circuit board so that the Reminder is on when the box is the right way up.

Construction

The speaker must be mounted in a box to produce a reasonable volume. We used a box of transparent plastic that comes with holes already drilled where the speaker is to be mounted. There is just room in this box for the circuit board and a holder for four AAA cells. If you use a larger box, you may have room for a holder for AA cells.

First assemble IC1 and its associated components, as shown on the left half of Fig.2. The orientation of the switch assumes that when the board is the 'right way up', it will be vertical with the connections to the loudspeaker at the top end. The leads of the switch are long enough to allow it to be twisted in other directions. Note the cut in the copper strip at A3. The LED may be wired to the terminal pins at E2 (anode) and G2 (cathode).

Having used a transparent box for the prototype we were able to solder the LED directly to the board, through holes adjacent to the terminals. When IC1 is connected, test the output from pin 11 (250Hz), pin 4 (4Hz, the LED flashes) and pin 3 (period 65 seconds). Then assemble IC2, noting that two of the tracks are not cut beneath the IC, and that you can use a solder blob to join pins 3, 4 and 5. Since Q1 is NPN and Q2 is PNP, don't get them mixed up, and also note that they face in opposite directions. Connect the speaker to the terminal pins at C30 and K30. Switch on and listen for the sound, a beefy four second burst of beeping every minute or so.

The various parts of the circuit just fitted into the case, so there was no need to provide any special mounting. However the speaker needs to be glued to the inside of the box. We used contact adhesive for this. Apply a thin bead of glue to the plastic rim of the speaker, and briefly place the speaker in its final position to transfer a small amount of adhesive to the inside of the box. This shows where you then need to apply more glue. Leave the adhesive to dry for about 20 minutes, and then press the speaker into position.

If the box is transparent you may find that the glue looks rather messy from the outside. We covered this by cutting out a ring of coloured paper and sticking this on the outside of the box with clear adhesive.

Before placing the circuit board in the box, check on the direction of the mercury switch capsule and also that the LED can easily be seen. With an opaque box you will need to drill a holder for the LED and fit a plastic LED mount.

The message surface is a rectangle of high-impact polystyrene sheet cut to the same size as one of the side of the box. Preferably this is the side through which the underneath of the circuit board is visible, so that the message surface hides this untidy sight. Glue the message surface in place using contact adhesive. ❖

Parts List

ors

25 W):
18k
180k
270k
1k
10k
5.6k

tors

C.
C2 0.1uF MKT or greencap
22uF 16VW electrolytic

Semiconductors

D1	Superbright LED, 5mm
IC1	4060 CMOS 14-stage counter/divider
IC2	4023 CMOS triple 3-input NAND gate
Q1	BC548 NPN transistor
Q2	BC327 PNP transistor

Miscellaneous

Mercury tilt switch; 8-ohm miniature speaker, approx 40mm diam; Plastic box, approx 82 x 54 x 42mm; stripboard 29 x 78mm (11 strips x 30 holes), 6 x 1mm terminal pins; 14-pin IC socket, 16-pin IC socket, 4-cell battery holder.

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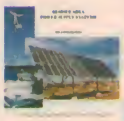

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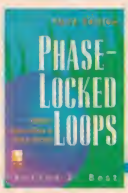

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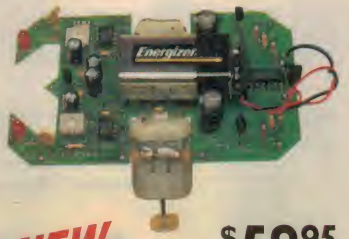

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K 3561 EA April '99

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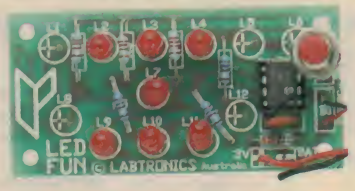

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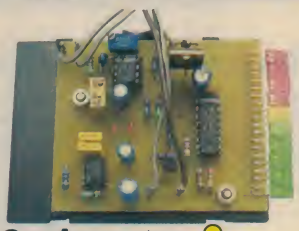

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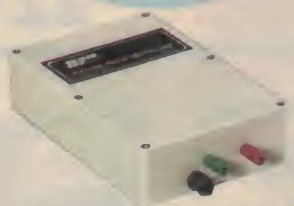

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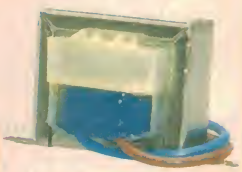

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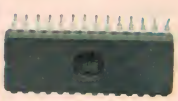

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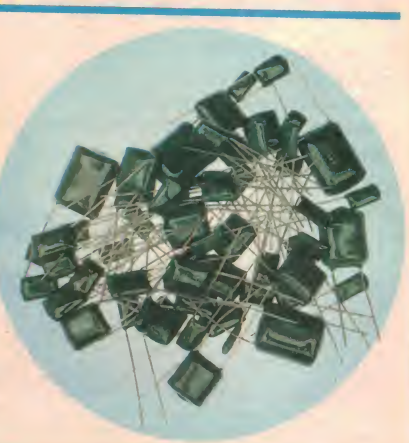

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32 Channel, 100MS/s Digital Logic Analyser - 2

As promised last month, here is the second article describing Peter Baxter's high performance logic analyser. It mainly discusses the Analyser's probing and trigger facilities, and how they're used.

by Peter Baxter

IN MY YOUNGER days I could solve any logic problem on my 4MHz Z80-based CPM systems with my trusty 15MHz oscilloscope. I have a mate who reckons he could do the same with his analog multimeter. Fair enough, we were smarter then. *Now*, I refuse to look at any electronic circuit problem unless I've got $50,000 worth of test gear sitting on my bench. I guess it's an ego thing.

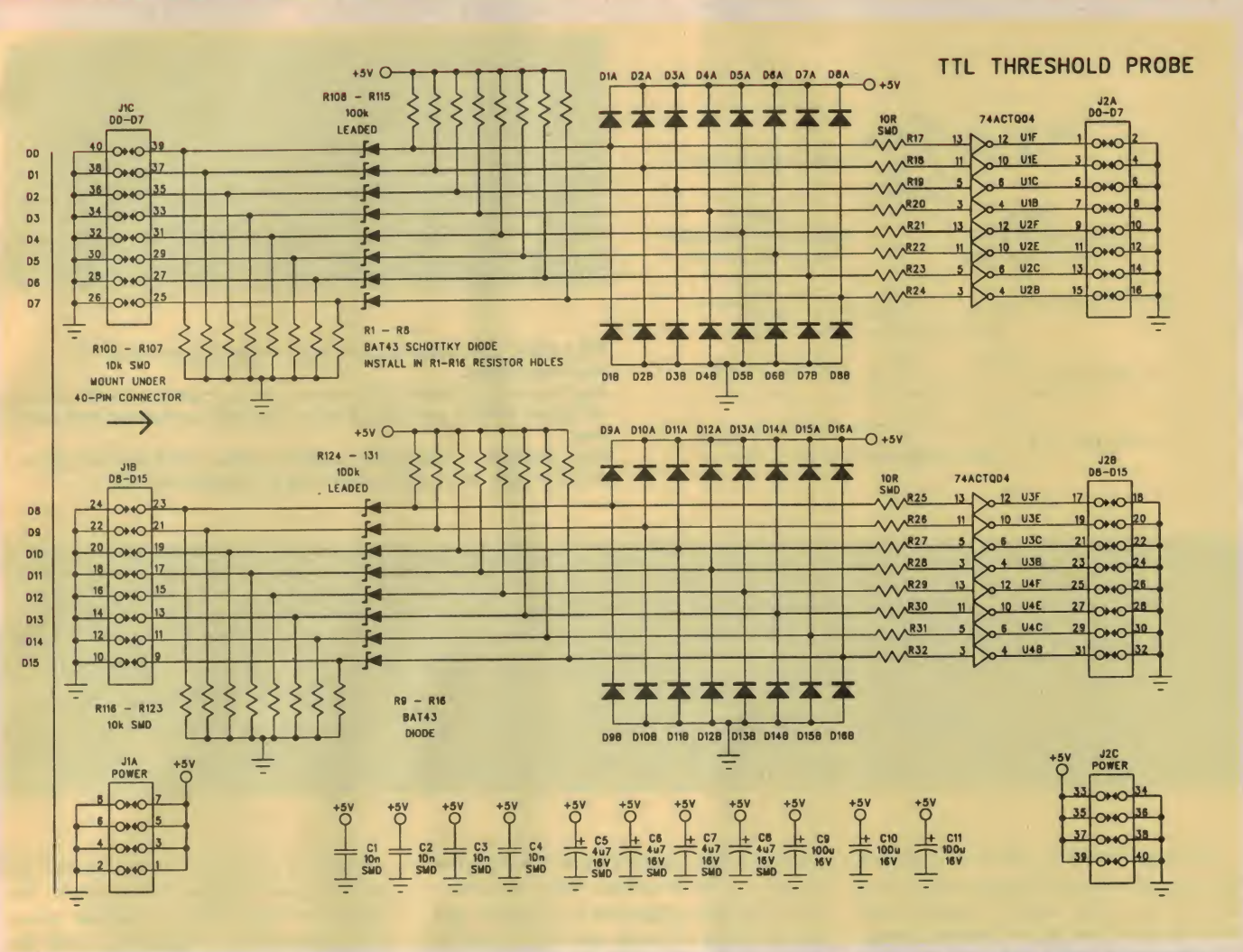
Of course it's all very well having fancy test equipment; you also have to be able to drive it. If you had a Logic Analyser right now, could you use it? So convenience of use is also very important; otherwise I might just as well have designed a multimeter instead.

In the first of these articles, we looked at the hardware aspects of the Logic Analyser. This time we're going to look at using the Analyser; firstly at how to 'Probe' your circuit, and then the heart of logic analysis: 'Triggering' and the various triggering modes provided.

Probing

One area we didn't discuss in part one was the Probe section. Probing relates to connecting your circuit under test to the Logic Analyser. This is done via the Probe box, which is essentially a buffer that drives the one-metre long, data acquisition cable back to the main Analyser box.

The buffer is necessary so as not to load the 'circuit under test' with a long, un-terminated, flat ribbon cable transmission line. If not correctly buffered, fast signal edges on your circuit under test's logic would cause signals to propagate up the cable, reflect off the far un-terminated end of the flat ribbon cable and come back and disrupt the circuit's



The circuitry inside the author's TTL threshold probe module, which provides minimum loading to the circuit under test while also driving the cable back to the Logic Analyser.

operation. This can't be overlooked in high speed designs — and by high speed, we don't just mean high clock frequency. It's the fast rising and falling edge rates on logic that matters too. Even with HC logic!

Therefore, the Analyser's probe box, flat ribbon cable and main logic box termination network form a 100-ohm terminated transmission line system. This is necessary to pass an accurate representation of what your circuit under test is doing to the main Logic Analyser box.

The connection from your circuit under test to the Probe box is done via test clips. These test clips are attached to a 40-pin header socket via a short length of flat ribbon cable. While this is useful for most applications, it is by no means the most convenient method or the best!

Usually, you will be developing your project over a long period of time, and will want to have a permanent connection to your project. You won't want to disconnect and reconnect 32 test clips every time you need to do work on the board.

A more convenient connection method might be to make a project-specific Probe cable without the test clips, and solder the loose ends directly to the signals on your project. Alternatively, you can put a header directly on your project board, into which you can plug a short, one-to-one piece of flat ribbon cable. Both of these methods require just one action to remove or replace the 16-channels of one Probe box quickly.

There's another method that is quite useful if you do a lot of work with wire wrapping. I have found that putting crimps on the ends of the test leads that will push over wire wrap posts is ideal.

You can even mix all of the above methods, depending upon what you're doing. As you can see the Probing side of the Analyser is quite flexible.

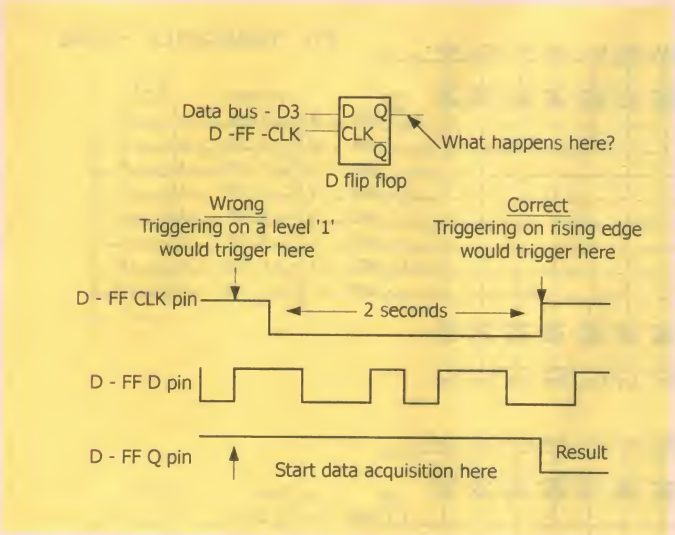
Triggering

While the triggering capabilities of a Logic Analyser are the most important feature, they can also be the most confusing. I've found that the more flexible a piece of test equipment is, the more difficult it can be to use. I've often been told by people that the reason they don't use Logic Analysers is that they look so frightening. You can't really blame them.

My objective with the Logic Analyser was to provide a piece of test equipment in which people could understand 90% or more of its capabilities. Too much technology these days is so complex that you never use more that 10% of what it can do; we are paying for features that we'll never use.

In this case I based the Analyser's triggering facilities around typical problems and requirements that you might have while developing a project.

One important requirement is to be able to trigger on a *rising*, or *falling* edge. While it might be easy to just trigger on a level '1' or level '0', most logic uses clocks. Trying to trigger on the clock input to a D flipflop by looking for a level 1 may result in you never getting what you really want. The Analyser might always be triggering early. False triggering is frustrating and unnecessary.



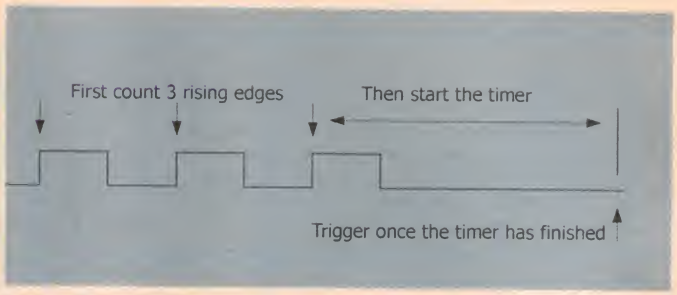
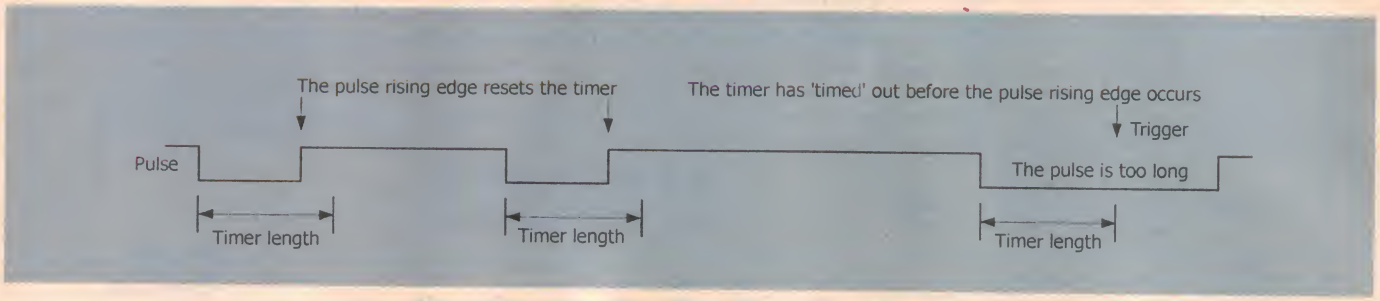


Fig.1 (left): The importance of edge triggering shouldn't be underestimated.
Fig.2 (above): The Analyser can be set to count a certain number of trigger events, and then trigger only after a programmed delay time.
Fig.3 (below): In advanced triggering mode, the Analyser can be set to trigger on exceptionally long or missing pulses.



The diagram of Fig.1 shows a D flipflop that has data clocked through on the rising edge of the clock signal. Imagine what would happen if we set the Analyser to trigger when the clock line is at Level 1. Sometimes it would trigger correctly because the clock line was initially at level 0. However, if the clock line was initially at level 1, the Analyser would trigger as soon as the Analyser starts data acquisition, because it would immediately see a 1. Yet if it triggered on a rising edge, it would acquire the right data which actually happens two seconds later. Don't under estimate the importance of edge triggering.

Edge triggering is available on the Analyser and it includes Rising Edge, Falling Edge as well as Change — either a Rising Edge or a Falling edge. This is often used when you want to trigger when something happens, but you don't know what level you're starting with. Quite a useful feature.

The total triggering set includes Rising Edge, Falling Edge, Change, Level 1, Level 0 and Don't Care. These options, in conjunction with the six trigger modes, allow you to focus in on exactly what you want. Within each Mode there is also a lot of flexibility, as I'll now explain.

Mode 1 — Basic Trigger: Here the Analyser will trigger when an Edge, Level or Hex number condition has been met. A Hex number would typically be an 8-bit data bus value or a 16-bit address value. Following after this basic triggering in sequence, you can have both a Counter and then a Timer to give even more flexibility in triggering.

The diagram of Fig.2 shows the Analyser counting a rising edge three times, then starting the timer. Once the timer is finished, it triggers.

The counter is useful for applications that require a certain number of clocks to happen, in order to perform an operation. Serial bus devices are a perfect example. They may require eight or 16 bits of command and address data to be clocked in on a rising edge, before clocking out data. What happens on the 17th clock?

The timer function is also very handy, enabling you to add a delay after an edge or level transition (and the counter, if used) has occurred. The timer's benefits are more obvious in Mode 2, where you might be testing pulse lengths.

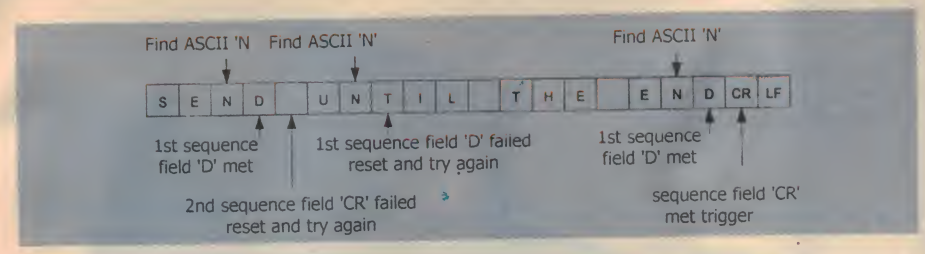
Mode 2 — Advanced Triggering: This is an extension of Basic Triggering. It essentially uses Basic Triggering's features, to get to the general area of interest. Then it uses further 'advanced' features to test whether a certain condition has or has not happened. If the condition is true, the Analyser will trigger. If it is not true, the triggering circuit will reset and go back to the start, to perform the whole process again.

Advanced triggering is very useful for checking pulse lengths. For example, the diagram of Fig.3 shows a situation where we're interested in triggering if ever the 'PULSE' line goes low for longer than 2us.

Modes 3 and 4: These provide advanced triggering with one 'sequence field', and advanced triggering with two sequence fields respectively. These modes combine all of the features of Mode 1 and Mode 2 while adding two extra 8-bit fields for time sequence detection. These two 8-bit fields sit on the lower eight channels, CH7 - CH0. These will usually be set up for the Data Bus. The sequencer is used to find a series of bytes of data in sequence. If it makes a match, it triggers.

In the example shown in Fig.4, the Sequencer is set up to find the end of a text stream in a consecutive set of bytes. We want it to find the word 'END', followed by a carriage return and line feed. We'll drop the 'E' from END, also the line feed and just look for the sequence 'N', 'D' and [CR]. This is because it can only effectively search for three items. The diagram shows that if it can't match the sequence, it resets and tries again. If it does matches the sequence, it triggers.

Mode 5 — Clock Stop: A special 'watchdog timer' mode, for monitoring system clock signals. For example, your project starts up fine and runs, then something happens and the whole system goes dead. What you want



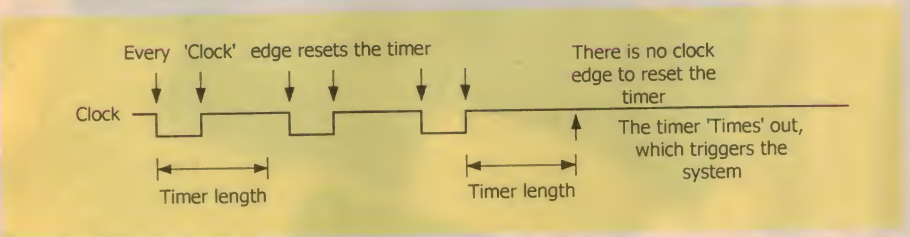
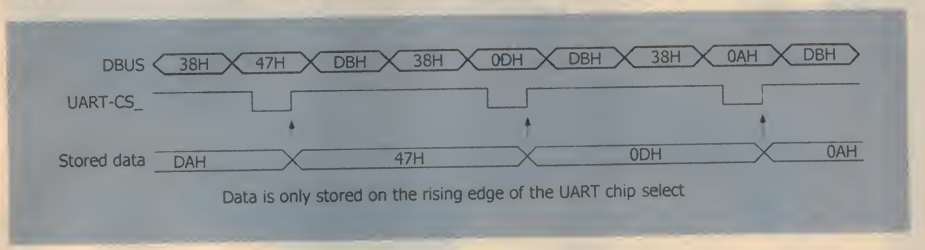


Fig.4 (top): In modes 3/4, the Analyser can be used to detect sequences of three selected 8-bit fields, such as ASCII characters.
Fig.5 (above): In Clock Stop mode, the Analyser can look for missing clock pulses.
Fig.6 (below): To avoid storing excess data, User Defined triggering can be used.



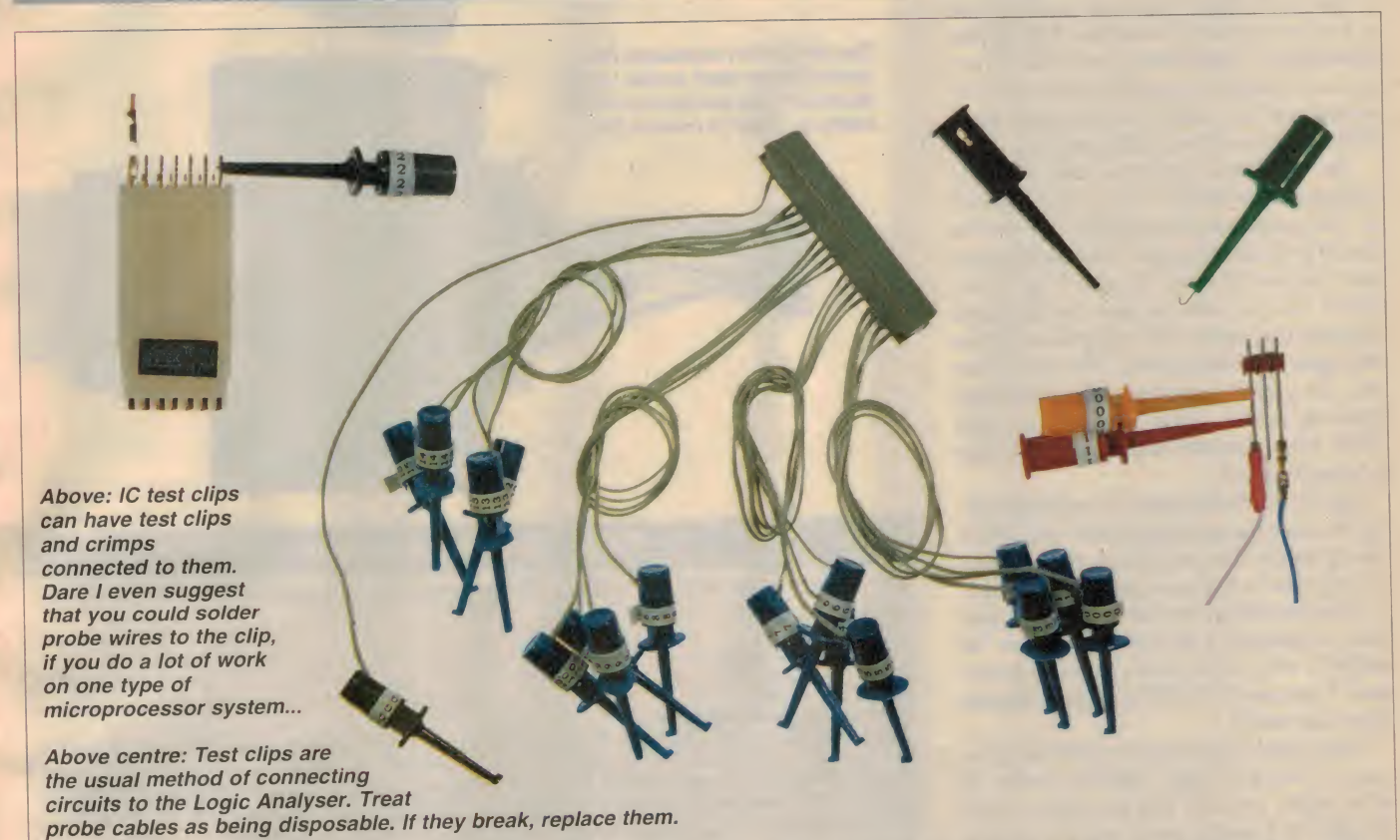
it to do is capture what happened, just as the clock stopped. This is what the Clock Stop mode is for (Fig.5).

Here the Timer is set to a length of time about two or more times the maximum clock cycle. Every time that the trigger circuit senses a change (i.e., a rising or falling edge), the Timer is reset and starts its time cycle again. But if it doesn't see a change (i.e., the clock stops), the Timer times out and triggers the Analyser. Appreciate that this can be used on any toggling signal, such as a data line or address line too.

Mode 6 — User Defined Storing: This is similar to state analysis. The idea is that you define the signal condition upon which data will be stored in SRAM. Data is only stored when that condition is met.

As an example, say you are monitoring a serial port and are only interested in the data that is clocked in from the UART onto the data bus. Instead of searching through a lot of unnecessary data to see what UART data was read in, you just get what you want by triggering only on the rising edge of the UART chip select line (Fig.6).

What I've tried to do is give a very brief overview of what you can do with the triggering facilities. A lot of effort has gone into producing triggering capabilities that are quite powerful.



Above: IC test clips can have test clips and crimps connected to them. Dare I even suggest that you could solder probe wires to the clip, if you do a lot of work on one type of microprocessor system...

Above centre: Test clips are the usual method of connecting circuits to the Logic Analyser. Treat probe cables as being disposable. If they break, replace them.

Top right: There are two type of test clips available. The one on at top right (supplied in the kit) is cheaper, larger and well suited for DIP components. The other is more expensive, has smaller pincers and is ideal for surface mount ICs. Another connection method (below) uses crimps soldered to the Probe wires.

Other features

Other features are also available in the Analyser. All of the 'SETUP' configuration information can be saved in EEPROM in a 'File' format. These can be recalled depending upon the project or problem you are working on.

An external storage oscilloscope can be triggered by the Trigger Out signal, so that an analog signal such as an ADC input can be captured as well as its digital value.

There is also a Help facility. When you are in a specific screen such as Trigger or Setup, pressing HELP displays the relevant help screen. These screens give basic information on usage of the particular function. The Trigger section has a multitude of Help screens due to the possibilities offered.

The Analyser's Waveform display (and also the LIST display) can be printed on an Epson or HP LaserJet printer. These can be attached directly to the parallel or serial ports on the back of the Analyser. Alternatively, the print files can be directed to a PC via the serial port. Once inside the PC, the file can be directed to a printer or imported into documents in a word processor such as Microsoft Word, using the HPG format.

The LIST display shows the captured data as text (not graphic) information. This display information is read directly out of SRAM and can be displayed as pure hex data or as a line number and time, relative to the trigger point. This screen is useful for state analysis.

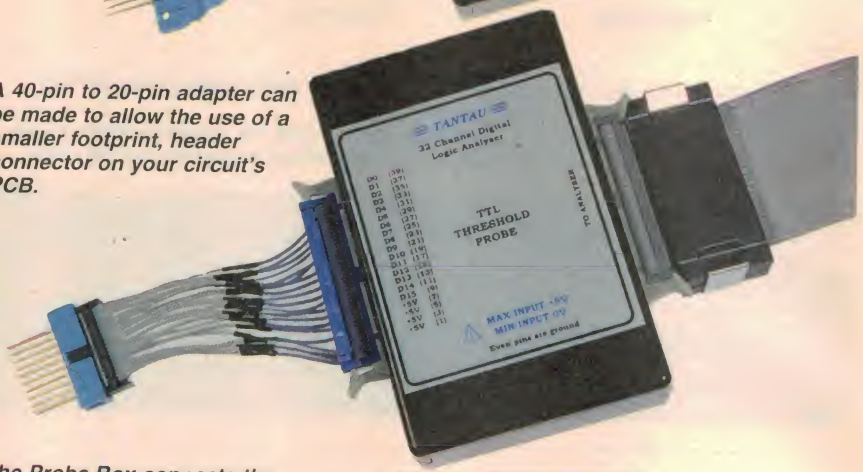
The Waveform display is what the Logic Analyser is all about. On it, you can see all of the waveform information just as you would in an oscilloscope. This display also has cursors (Trig to A and Trig to B), which can be used to read the Data and Address bus values of the captured data at that specific point in time. The cursors can also be used to measure time differences between points. There are hot keys that allow you to quickly display a new section of captured data.

One of the final points is its upgrade ability. Because the operating system and FPGA configuration files are held in Flash memory, upgrades and improvements can be easily implemented by the user. The latest version of software is always available on the author's web site for users to freely download. I can also offer full support to anyone who may need it.

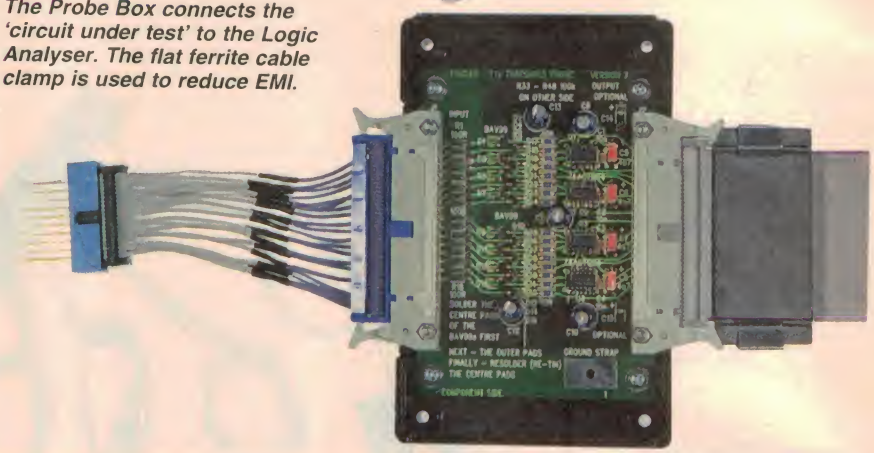
Once again, I've just given a brief description of what the Logic Analyser can do. In your hands, you will find uses that I never thought of. I would never want to tackle a logic project without one. It's just wasting time! This Logic Analyser is a tool that will be useful to you for a very long time. ❖

A 40-pin wire wrap socket can be used to connect to your circuit. Large, but quick!

A 40-pin to 20-pin adapter can be made to allow the use of a smaller footprint, header connector on your circuit's PCB.



The Probe Box connects the 'circuit under test' to the Logic Analyser. The flat ferrite cable clamp is used to reduce EMI.



Kits, more Information

Kits for the Logic Analyser described in this article are available from the author at:

Tantau Australia
PO Box 1232,
Lane Cove NSW 1595.
Phone (02) 9878-4715
Fax (02) 9888-7679
email peter.baxter@tantau.com.au

The normal cost of a complete Logic Analyser kit is A$1275 within Australia, or A$1300 in New Zealand. The Analyser is also available in fully assembled and tested form, for A$1725 (Australia) or A$1750 (New Zealand). However as a special offer for *EA* readers, the price for February and March 1999 will be A$750 and A$1250 (assembled and tested) in Australia and respectively A$800 and A$1300 in New Zealand.

More information on the Logic Analyser is also available from the author's web site at:

http://www.tantau.com.au

The website also allows you to download the complete manuals for the Analyser.

Web watch

by Graham Cattley

THE AUSTRALIAN Electric Vehicle Association website at **http://www.aeva.asn.au** covers, er — electric vehicles in Australia. They keep up with the latest in EV news, including the Sunrace99 rally that recently ran from Sydney to Melbourne. As well, they cover a lot of international events and technological advancements, covering everything from the latest electric buses in Sydney through to British milk floats. If you elect to join the AEVA, you too can receive the bimonthly newsletter 'EV News', which covers a lot more on the subject.

THOMAS ALVA EDISON was certainly a busy bloke — he patented over 1000 inventions in his 60-year career, and apart from everything else he left us with a number of audio and video recordings safely hidden away in the US Library of Congress. Hidden, that is, but not forgotten. The Edison Home Page at **http://lcweb2.loc.gov/ammem/edhtml/edhome.html** offers not only a timeline and biography of the man, but a number of Edison's early films digitised and available for download in MPG or QuickTime format. There are a number of other early films on offer as well, but be aware that some of the files run to around 40MB, so be prepared to be on line for quite a while...

AT FIRST I THOUGHT that a wooden computer woodn't go — but I was wrong. Paul Stanley (or 'Pop' as he is known) has built a baby PC based on a 386DX-40 processor, and instead of the large beige steel case we've all grown to hate, he's gone and made a custom wooden box for it instead. Head on over to **http://skyscraper.fortunecity.com/nova/229/woodenpc** for all the details on 'The Coffin', as he calls it.

HOME CINEMA CHOICE is a British publication whose aim, in their own words 'is to become the definitive home cinema resource on the Internet'. More power to them I say, because not only do they review a wide variety of home cinema equipment, they also pass on some information that could be of great use to anyone who has recently bought a DVD player. Information on how to 'modify' the players to play region 1 discs for example.

It turns out that all some DVD players need are a particular secret key sequence on the remote control, while others might require a bit of soldering. In the end though, you should be able to watch the latest US releases — assuming you can get the Region 1 discs, that is...

The mods aren't guaranteed of course, and will only apply to certain models of particular brands of players, but it's worth a look at their page at **http://homecinemachoice.com** to see if your player is listed.

FURBYS WERE ALL THE RAGE last Christmas, with Hasbro selling the furry robotic toys just as fast as the factories could pump them out. The Furby was the invention of Dave Hampton, who was a designer for Mattel in the 1980s. He decided that what we *really* needed was a larger, animated version of the Tamagotchi, and it now seems that the world has been blighted with his creation ever since. Unfortunately (or fortunately, depending on your point of view) Furbys don't always live as long as planned ("It was something in his mechanicals, doncha know..."), and so this page is dedicated to a Furby Autopsy. On the How-To page you'll find the best way to skin your (dead) Furby, and how to dismantle the ears, while the Guts & Stuff page covers the operation of the various motor functions and 13 sensory inputs and outputs. There are also a couple of Furby FAQs covering Furbys in general, and one on the potential to hack into your Furby's sensory system. It's all good fun, and in reasonable taste, so have a laugh at **http://www.phobe.com/furby**. ❖

ALTRONICS COMPONENTS

ALTRONICS Fax Order Line: (08) 9328 3487

Our BIGGEST Catalogue YET!

244 pages packed with hundreds of exciting new products including a new computer & power supply section & expanded data section!

If you haven't received a copy of our 1999/2000 Engineering Catalogue, call us NOW on

1-800 999 007

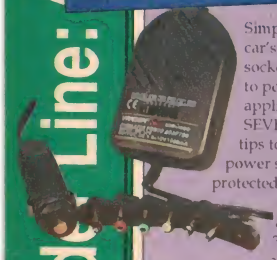
for your FREE copy (normally $3)

What a fantastic array of bargains to choose from this month, the value packed S 5490 DSC Alarm System, the T 5020 Aluminium Tool Case, T 2600/1 Iroda Gas Irons featuring a BIG 33cc capacity reservoir. Build a quality Solar Powered system with a Powerhouse/Solarex combination plus many more products at HUGE discounts! These and many more products are now available for you to browse on our online catalogue at www.altronics.com.au 24Hrs a day!

Best Regards,
Jack O'Donnell, Managing Director

1.5A Regulated Car Adaptor

Suitable for portable radio, TV, CD Player, Electronics games, calculators, etc.



Simply plugs into your car's cigarette lighter socket, and allows you to power a myriad of appliances. Includes SEVEN interchangeable tips to suit most DC power sockets. Fuse protected. All voltage settings except 12V are regulated, 1.5, 3, 4.5, 6, 7.5, 9, 12V at 1500mA.

M 8620 **$29.95**

PIR Movement Detector

2 Year Warranty

Famous Australian Made NESS Quantum PIR

Features: • Small size • User Selectable Pulse Count On-Off• Dual Element Pyroelectric Sensor • Surface or corner mounting • N.C. Alarm contacts in standby condition • Tamper switch • Adjustable Beam Height Angle • Single pulse or triple count • Exceptional RFI and ESD immunity

1000's sold, and not ONE unit returned! Be aware of cheaper imported products which could cause false triggering and compromise the integrity of your security system!

S 5305 Last Year $49, NOW **$39**

only when purchased with the DSC system.
Buy 2 for ONLY **$65!**

5 Sector DSC Alarm System with Auto Dialler

This system is the same type used by commercial alarm companies.

This alarm can be configured to automatically dial two preset numbers in the event of an alarm. The entire system is controlled and programmed via a keypad.

S 5490 **$299**

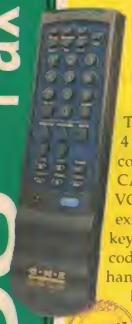
Features
- 4 User Codes
- System test function
- 4 Sectors + 24Hr Zone
- Silent Alarm
- Quick Arm
- Zone bypass
- Door Chime
- Battery B/Up

Improve the security of your home or business with this micro-processor controlled alarm, & get $150 worth of accessories FREE!!

Super Bonus Deal!

Purchase a S 5490 5 Sector Alarm system during this month, and we'll supply ***$150*** worth of accessories ***FREE!!!*** Bonus package includes W 2346 50m of 4 Core Sec Cable, M 9710 Plugpack, S 5075 Backup battery, S 6130 Siren, S 5445 Blue Strobe, 2 Large alarm stickers and 4 window stickers!

4 in1 Pre-Programmed Remote Control



Can't find the right remote when you need it ? This 4 in 1 is the answer. It combines the functions of your TV, VCR and CATV into just one unit!

This compact remote control can replace up to 4 existing appliance remote controls. It can be configured to control your Television, VCR, CATV & one auxiliary device. ie. A second TV, VCR, etc. To program the functions of your existing appliance into this remote you simply key in the appropriate codes as listed in the handbook provided.

Includes pre-programmed codes to suit all popular makes of Televisions, VCRs and CATV.

Don't spend $100's on an original remote when you can have all the same functions for a fraction of the cost!

Thermometer & Hygrometer

Ideal for use in hydroponics, garden centres, shade houses, monitoring air conditioning, aquariums, wine cellars, etc.

Features • JUMBO LCD displays temperature & humidity • Memory function • -10°C to +50°C temp. & 25% to 95% humidity range with +5% accuracy • Desk / wall mounting

A 0155 **$55**

Indoor/Outdoor Hygrometer

Features • Dual display for internal/external temperatures • Memory function • 3m lead • Desk / wall mount

A 0145 **$35**

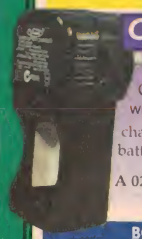
Fantastic for tropical fish aquariums, fish ponds, spas, saunas, home brewing setups.

FLAT WHOPPER WIRE!

Super Low Loss, high quality heavy duty flat speaker cable at a bargain price! Massive power handling, flexible and super tough translucent insulation. Ideal for laying under carpet in your car, home theatre, etc.

W 2140 Normally $110/50m Roll,
SPECIAL INTRODUCTORY PRICE
$100 per 50m Roll

Compact 240V Plug-In NiCad Battery Charger



Charge your batteries in *less than 8 hours* with this versatile charger! Charge either 2 (5hrs charging time) or 4 (7hrs charging time) AA batteries at a time.

A 0285 ONLY **$19.50**

BONUS OFFER For this month, with every A 0285 charger, receive 4 x S 4705 700mAh NiCad Batteries Valued at $10 FREE!!

12" Subwoofer Driver

Just the shot for adding some wallop to your hi-fi, car audio, or home theatre system. This 300mm 8Ω sub driver features a super-rigid Poly Emulsion Coated Cone (PECC), with a high-efficiency foam surround has low-Q, low resonance and high efficiency.

Pmax: 100W RMS, **Fo:** 25Hz
Sensitivity (1W/1m): 92dB
Qts: 0.342, **Vas:** 207.8L
C 3100 Normally $99,
NOW JUST **$65**

WANT BASS? Try this 12" beast for size!

Crimping Tool

This professional quality crimp tool is a fantastic addition to your technical tool kit. With proper care, it will virtually last a lifetime! Suits red,blue and yellow automotive type crimp lugs.

T 1552 Normally $54,
NOW **$39**

150+ Assorted Crimps Kit

10ea 6.4,4.5,2.3 Female/Male spade, mini spade lugs, ring terminals, fork lugs, multi-point joiners, 5ea Red/Blue/Yellow inline cable joiners & 5 blue 6.4mm piggyback spade lugs

H 1800 *NOW ONLY* **$13.95**

NiCad Batteries with tags...

...for toys and cordless tools

Sooner or later, your model racing car or cordless drill will stop when the batteries give up. Take advantage of these LOW PRICES to put some life back into your toys and cordless tools!

S 4605 800mAh AA Cell with tags
ONLY **$3.50** ea, or **$3** ea, 10 & up

S 4608 1800mAh C Cell with tags
ONLY **$6.80** ea, or **$6.50** ea, 10 & up

Aluminium Tool Case

This quality aluminium tool case features 5 adjustable dividers for organising your tools and equipment, it also includes 17 tool pockets in the removable lid insert which can be used for smaller hand tools. Supplied with 2 keys and measures 460 x 325 x 150mm. Ideal for technicians, photographers, hire companies, salespeople, etc. *Note: Tools not included.*
Not all tool cases are the same, beware of inferior quality cases.

T 5020 **$65**

Beware of inferior tool cases with plastic sides! The Altronics T 5020 Tool Case has all aluminium panels!

1-800 999 007 PERTH (08) 9328 1599

OVERNIGHT DELIVERY

ALTRONICS Fax Order Line: (08) 9328 3487

POWERHOUSE INVERTERS

Operate 240VAC appliances from a 12 or 24V battery ANYWHERE, ANYTIME!!

Using the latest MOSFET output stage and toroidal transformer these inverters are super efficient and will deliver high surge currents. The auto-start mode enables the inverter to remain connected to the battery(drawing only micro amps) and springs into life once you turn on your equipment, saving precious battery power. Some uses are camping, boating, fishing, mining, farming, & remote settlements.

Features: • Dual AC Power Sockets • Auto-start standby mode • Sturdy rust proof ABS case • Heavy duty battery leads • LED status • Circuit breaker protection (600W & 1200W models)

K 6755 300W 12V Input
K 6756 300W 24V Input **$449**

K 6777 600W 12V Input
K 6779 600W 24V Input **$749**

K 6797 1200W 12V Input
K 6799 1200W 24V Input **$1079**

All models now include PHASE CORRECTION to run inductive loads. ie.fridges, pumps, small motors,etc.

Solarex® Solar Panels

NEW

Made in Australia

10 Year Warranty

Designed for the harsh Australian outback, all models incorporate a robust low profile aluminium frame enabling them to be mounted on the roof of Caravans or Boats, etc without protruding above the vehicle causing undue drag. They provide 12V DC output with the exception of the N 1030, N 1050 and N 1080 which are easily configured for 6 or 12 volts. This allows the modules to be configured to meet any design requirements and enabling bypass diodes to be added to prevent damage to the panel if required. Various voltages can be produced by connecting the modules in a series or parallel configuration.

FANTASTIC FOR BOATING, CAMPING, CARAVANS, REMOTE AREA POWER SYSTEMS, RECREATION VEHICLES & 4WDs

Part No	Power (Watts)	Weight (Kgs)	Dimensions(mm) H	W	D	RRP
N 1005	5	0.77	250	269	23	$160
N 1010	10	1.5	420	269	23	$195
N 1020	20	2.5	416	500	23	$290
N 1030	32	3.5	588	660	23	$350
N 1050	53	5.5	933	660	23	$515
N 1080	80	9.5	1105	660	50	$745

*Power rating are quoted at STC of 1000 W/m2 & 25°C cell temperature

6.5A Solar Panel Regulator

Most photovoltaic panels require an external regulator to avoid the overcharging of batteries.
Features: • Reverse polarity protection • Temperature compensation • *PWM* Pulse Width Modulation charging • LED indicator and is housed in a rugged all aluminium case • Encapsulated in epoxy for a durable weather resistant seal to suit any conditions. • 5 Year Warranty

N 2060 **$95**

PIR Door Minder & Alarm

Ideal door minder for shops, automatically announces when customer arrive! Similar models sell for over $100 or more!

An excellent DIY unit for use in home, office, shops,etc. Two modes of operation: • Entry/exit chime activated by an external switch or by movement detected by the PIR. • Alarm mode, when activated the alarm sounds for 30 seconds. *Features:* • 10 Metre detection range • Simple and easy to install • Self-contained unit • Swivel mount bracket • Remote doorbell contacts • Doorbell only operation when in Off mode • Ideal as a travellers intruder alarm

S 5320 **$39.95**
M 9600 9V DC Plugpack to Suit **$13.50**

19 Range Digital Multimeter

This DMM is small enough to literally fit into your pocket! Great for the trades person on the move, or for a student lab kit. Includes an audible continuity buzzer, 'K' type thermocouple, and square wave test signal output. Measures DC Volts to 1000V, DC Amps to 10A, AC Volts to 750V, resistance to 2MΩ and temperature from -20°C to 1370°C. It even includes a diode test function! Measuring only 70 x 126 x 25 mm and weighing only 170g, this meter is a pocket rocket with a price to match!

Q 1051 Was $29 NOW JUST **$20**
Q 1054 Carry Case ONLY **$5**

Includes Temperature Probe & Thermocouple for Measurements up to 1400°C!

Laser Pointer

Maximum Permitted Power Output 1mW

This little keychain unit is also ideal for lectures, seminars, building sites, guided tours, and it's much less intrusive than a standard "stick" type pointer. Uses three button cells (included). Complies with new regulations governing the output power of laser pointers. (< 1mW output) (refer to *Batteries* section, for S 5006 S 5013 to suit)

A 0205 **$19.95**

NEW LOW PRICE FOR 1999!

33 Pcs Driver Bit Sets

The Holy Grail of screwdriver bit sets!

All housed in a handy plastic holder. Great for the toolbox, workbench, etc. Suitable for use with battery drills or most hex bit drivers.

T 2182 Driver Set contains: • 5 Slotted, 3, 4, 5, 6, & 7. • 8 Phillips, #0, 2 x #1, 3 x #2, 2 x #3 • 7 Pozi, 2 x #1, 3 x #2, 2 x #3 • 6 Hex (Metric), 2, 2.5, 3, 4, 5, 6. • 6 Star, 10, 15, 20, 25, 30, 40. • 1 Magnetic Bit holder

T 2180 Security Bit Set contains: • 4 Triwing, 1, 2, 3 & 4. • 9 Torx, T8, T10, T15, T20, T25, T27, T30, T35 & T40. • 4 Snake Eye, 4, 6, 8 & 10. • 12 Hex Metric 2, 2.5, 3, 4, 5 & 6. Imperial 5/64", 3/32", 7/64", 1/8", 9/64" & 5/32". • 3 Torque, 6, 8 & 10 • Magnetic hex extension bar

T 2182 **$13.95**
T 2180 **$13.95**

BONUS! Buy Both sets for **$26**

1.5A Regulated Supply

This compact sturdy power supply is capable of delivering a constant 1.5A at 3V,4.5V, 6V, 7.5V, 9V and 12V. Being regulated, the output voltage varies only minimally from full load to no load making it ideal for voltage sensitive devices like portable TV sets, video games, tape recorders, radios, scanners, computers. Features a mains on/off switch, power on indicator and binding post connections.

Includes Short Circuit, Thermal & Overload Protection!

M 8230 Normally $49, NOW **$39.95**

Intelligent UHF Remote Control

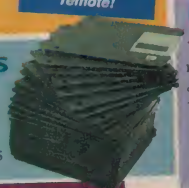
This miniature intelligent *learning* remote control can be used as a replacement for your car remote control or to combine more than one remote. ie. Garage door, car, motorbike, home alarm, etc.

Features: • Four programmable buttons • Easy to program • Wide operating frequency range of 255-500MHz • Includes alkaline battery

Put your car alarm and garage door opener on one handy remote!

A 1015 *ONLY* **$39**

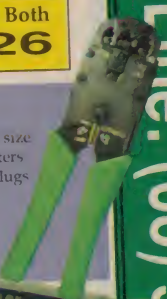
1.44Mb Floppies



IBM Formatted Double Sided High Density 3.5" 1.44MB disks. 100% Error Free, Lifetime Warranty

D 0100 **$12.95** Pack 25

Pro Crimping Tool



This heavy duty, all metal deluxe tool will crimp all size modular plugs from 4 to 8 way. Also has inbuilt cutters and wire stripper that strips to accurate length for plugs

T 1570 *REDUCED PRICE FOR 1999*

$159

T 1572 Replacement Blades $6.50

Kodak Gold CD-R

Premium quality CD-Rs plus jewel case. *Beware of cheaper inferior quality products that are prone to failure.*

D 0240 Normally $4.95,
$4.50 ea
or **$3.95** ea 10 up

NEW

SPECIAL INTRODUCTORY PRICE!

3 Button Serial Mouse

This easy to use mouse is suitable for most IBM® compatible computers. Features 3 buttons, 9 pin connector, 1.5M lead. Microsoft® Windows® compatible. Can be programmed for left handed users. Includes software.

D 2050 ONLY **$12.95**

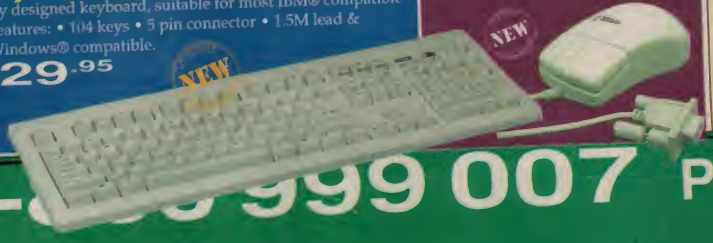
NEW

104 Keyboard

Ergonomically designed keyboard, suitable for most IBM® compatible computers. Features: • 104 keys • 5 pin connector • 1.5M lead & Microsoft® Windows® compatible.

D 2100 **$29.95**

NEW



LAN Cable Tester Kit

This handy unit can test continuity, open/short and cross wired LAN wiring or modular leads.

Features: • Auto/Manual Scan modes • LED indicators for all connections including Ground • Will test 10Base-T, 10Base-2,RJ45/RJ11, 258A, TIA 568A/568B and Token Ring • BNC to RJ45 Adaptor included • Includes Soft carry case

D 3010 **$169**

NEW

NEW LOW PRICE FOR 1999!!

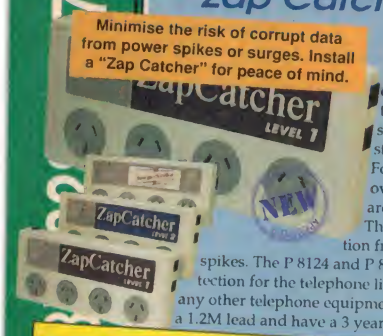
Save hours of tedious fault-finding, only to find that the *wiring* is the problem!

1-800 999 007 PERTH (08) 9328 1599

ALTRONICS COMPONENTS

"Zap Catcher" Power Protection

Minimise the risk of corrupt data from power spikes or surges. Install a "Zap Catcher" for peace of mind.



Protect your valuable electronic appliances from the effects of power surges, indirect lightning strikes & electrical noise. Four power sockets and overload circuit breakers are offered on all models. The P 8122 provides protection from power surges and spikes. The P 8124 and P 8125 also incorporate protection for the telephone line for your modem or any other telephone equipment. All models come with a 1.2M lead and have a 3 year warranty.

P 8122 Surge & Spike Protector for Mains **$65**

P 8124 Surge & Spike Protector for Mains & Tel. **$95**

P 8125 Filter, Surge & Spike Protector for Mains & Tel. **$149**

120W Gas Soldering Iron

AT LAST! A BIG GAS IRON!

This butane powered iron has a HUGE 120W heat capacity. Features a "one-touch" piezo ignition for super-easy starting, and a thumb-wheel heat control. The massive 33cc gas storage chamber is refilled using a standard butane refill canister. A MUST for installers, mobile technicians, on-site service personnel, auto-electricians etc.

WHY PAY $200 OR MORE for a 17cc tank size when you can have a 33cc for only $89!

T 2600 Normally $99, NOW A CRAZY **$89** ea

"This has all the convenience features of a normal gas iron, such as quick heating, no power cords, light weight and best of all, it comes with a blow torch tip." Silicon Chip Magazine, Sept '97

For this month only!!
SUPER SPECIAL! The first 100 callers to purchase a T 2600 or T 2601 receive a roll of T 1100A solder and a T 2449 Butane Refill, together valued at $10.45 FREE!

7 in 1 Pro 120W Kit

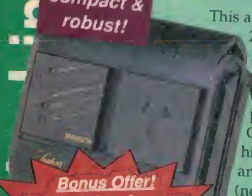
The T 2601 kit comprises of the *T 2600* Gas Soldering Iron PLUS a handy carry case with a range of tips and accessories including cleaning sponge, solder dispenser, blow torch, hot air blower and hot knife cutter.

T 2601 Normally $149, NOW **$129** ea

MASSIVE 120W Heat capacity! Simple "thumb-start" piezo ignition refillable gas storage!

125W Mini Inverter

Powerful, compact & robust!



This amazing inverter provides up to 125W of 240V AC power from your car cigarette lighter socket! During our evaluations, it ran our entire A/V room setup, including a huge 68cm television and A/V amp! Can power televisions, VCR's, lights, Phone and Camcorder battery chargers, shavers and hi-fi systems. Features low battery indicator and overload shutdown. Built-in 3-pin plug (no adaptor required). Includes car cigarette lighter socket lead.

Bonus Offer! This month only, every M 8105 comes with a P 0150 featured below absolutely FREE!!

SAVE $30!

M 8105 ~~$159~~ **$129**

Car Cigarette Lighter Double Adaptor

Plugs into your car cigarette lighter and converts it to a dual outlet. Ideal for use with the M 8105 inverter above.

P 0150 **$12.95**

Capacitance Meter Kit

(Feb SC '99)

Instantly verify capacitors with unclear or rubbed off,or suspect caps

If you have an old junk box filled with capacitors with the values rubbed off, or you have a requirement for closely matched capacitors then try this capacitance meter project. This hand held meter project will read capacitance from a few picofarads to 2µF. The project will display the unknown value in three ranges pF,nF and µF on an LCD. Features • Supplied with provision for 12VDC,9-12VAC plug pack or 9V battery operation • Housed in an attractive UB3 jiffy box • -± 1 digit display tolerance • Measures 1pF to 2µF capacitors.

K 2526 **$64.95**

Low Distortion Audio Signal Generator Kit *with Digital Frequency Display*

(SC Feb '99)

A low distortion wide frequency audio oscillator is always a useful piece of bench test equipment for the enthusiasts or technicians Features • screened and punched red perspex front panel • display on/off switch • float/ground switch • 10Hz - 100kHz in four ranges • super low distortion • Output 3.16Vrms sine wave maximum, 3.16 V peak square wave. • Output impedance 600Ω • Sync output • high slew rate • digital frequency readout. *See our 1999 Catalogue for full specifications.*

An essential piece of test gear for servicing audio equipment with the bonus of digital precision!

K 2548 **$199**

200W Mosfet Amplifier Module & Power Supply Kit

(Designed by Altronics)

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ALTRONICS Fax Using

Information Centre

by Peter Phillips

The future of Windows, batteries, the US NAMM show and more

This month's column includes a few news items from the USA, a discussion on the memory effect of NiCads (is it a myth?), and some more on car lighting problems. There's also a letter about the effects of pulsed magnetic fields on human health, and the usual project inquiries.

IN LATE JANUARY, I visited the USA to help a fledgling California-based company get a number of products ready for the Winter NAMM (National American Musical Merchants) show. The company's products achieved a huge level of interest and included an electronic keyboard (with lots of differences to those currently available) and a MIDI-compatible player piano. It was an exciting experience to be involved in getting the products ready on time, setting up the display and dealing with industry representatives.

I mention this, as it illustrates an aspect of electronics we often ignore: its diversity, which can take you into so many areas. My involvement in this company came from my interest in electronic player pianos and MIDI music, and could involve further trips to the US and other parts of the world.

Like most things in the USA, the NAMM show was huge. For trade representatives only, it was held at the Los Angeles Exhibition Center, which is around 10 times larger than the Sydney Darling Harbour Exhibition Centre. It was filled with exhibitors showing off their range of musical instruments, keyboards, music software, audio hardware; in fact anything to do with music.

As you can imagine, I saw a huge range of interesting products, including the 'Stick', a guitar-like instrument which is held vertically and played by pressing and manipulating the strings. It has electronic transducers that pass the sound to an amplifier, and is capable of quite extraordinary sounds. It's also claimed to be easy to play. Space precludes me from covering other aspects of this show, but if you are in the music industry, this is the place to be. It's held twice a year, with the next one at Anaheim (California) in July.

While in the US, I avidly read the local press, searching for items that might be of interest to *EA* readers. Our two month lead time means some of the following might have been reported in the local press by the time you read this, but in case not, here's a few things I hope will interest you.

Y2K bug in the US

While in the US, I experienced my first rub with the Y2K bug, at Los Angeles airport. Quite a few credit card phones there are not yet programmed to accept cards with an expiry date in 2000, only those up to 1999. I guess this is not a world-stopping problem, but according to the *Los Angeles Times*, the US still has quite a way to go in dealing with the Y2K bug. For instance, the District of Columbia is reported to have made compliant only about 2% of its critical systems.

A November 1998 survey found that only a third of state computer systems dealing with seven major federal welfare programs were year-2000 compliant. Furthermore, only seven states have a Y2K readiness of between 75% and 100%. The reason is 'lack of funding', which seems odd in a country with a projected budget surplus of several trillion dollars.

However, the *Wall Street Journal* (Monday, February 1) reports that Canadian province Nova Scotia is well ahead of the pack, at least with its Cape Breton Island power station. Rather than wait and see what would happen, the management has rolled to clock forward to 2000, and confirmed everything has remained running. To date the station has passed two critical dates: December 31, 1999 and March 31, 2000 — the 99th day of the new century. Another critical date is September 9, 1999, or 9/9/1999.

No other US utilities have followed Nova Scotia's lead, which although requiring a lot of work, cost less than A$10 million. According to the report, the power company spent over four months taking stock of its systems containing computer chips, with 10% of those counted being date dependent. Remaining chips, although not date dependent, still need to be checked.

The Internet

The Internet gets a mention almost everyday in the US press, ranging from concerns about Internet stocks, Intel's new processor that sends a serial number while you're online, and discussion on handling offensive material sent over the net.

There's no doubt the Internet is becoming popular at an ever-increasing rate. For example, Compaq has reported sales of more than US$1 million a day for its new Prosignia PC line, which is sold directly to customers via the phone and Internet.

At the time of writing, there's a lot of talk in the US about making money from shares in Internet companies, with the *Wall Street Journal* suggesting Yahoo! and America Online as the two best stocks. But the general view is that dealing in Internet stocks is like playing Russian roulette with only one empty chamber.

Perhaps the hottest topic, though, concerns the threat the Internet could have on Windows, Microsoft's most profitable product and reportedly the operating system on 95% of the world's computers.

Civil war at Microsoft

Again I'm getting the following from the *Wall Street Journal*, which includes an article titled 'How Microsoft's ranks wound up in civil war over Window's future'. It starts with this introduction:

In March 1997, Microsoft Corp's top managers crowded into the conference room in headquarters building 27, anxious to see how chairman Bill Gates would resolve one of the most profound internal conflicts in the company's history.

The question that needed to be resolved was whether Microsoft should continue with Windows development, or throw its resources into a very real threat from arch-rivals Sun Microsystems and Netscape

Communications Corp, who had combined to develop Netscape's Web browser with Sun's new Java software, allowing it to run on any kind of computing device.

The threat had caused a large group within Microsoft to urge the company to recognise that Windows, with all its complexity, was likely to become redundant. This group was led by senior vice president Brad Silverberg, opposed by another group led by another powerful VP, Jim Allchin. In characteristic style, Bill Gates let the two camps compete for some months, a favourite tactic when Microsoft faces a new challenge.

But wily Bill knew something the group against Windows did not: the much vaunted Java software code was not delivering the goods, and was proving to be slow and unable to run effectively on all systems. So, at the March '97 meeting Bill made it clear Microsoft would continue with Windows development, and rather than fight Sun and Netscape, it would make a browser an integral part of Windows.

This has proved incredibly successful, with Microsoft reporting in January (1999) a net profit margin of 40%, and a cash hoard of US$19 billion. Microsoft now has the lead in browser software market share, and Netscape has agreed to be acquired by America Online Inc.

But according to the article, this tactic might only have bought Microsoft some time, as the Web has spawned an explosion of cross-platform software not hooked to Windows. Increasingly, users are taking advantage of applications on the Web, from email to book-buying to tax preparation, using simple browsers rather than complex Windows software. Even Bill himself is reported to have conceded the diminishing importance of Windows. Interesting times!

I could fill the whole column with more US news, but we need space for reader letters, so let's start with a letter on my favourite topic: batteries.

What memory effect?

I received the following email with a subject title of 'Another battery error!' It's about the so-called memory effect in NiCad batteries, but our correspondent lets me off the hook by starting his email with "Don't worry, it's just a little one this time." Phew!

In the February 1999 issue, you say 'to reduce the memory effect (loss of capacity) a NiCad (or NiMH) cell should be discharged before charging it'. This is incorrect and I direct your attention to website http://www.repairfaq.org/ELE/F_NiCd_Battery.html for a detailed explanation.

In brief, what most people call 'memory effect' is really a combination of voltage depression resulting from the overcharge performed by all consumer battery chargers, and natural cell aging. Voltage depression does not greatly reduce cell capacity, but it does change the shape of the cell discharge curve in which the cell's voltage drops abnormally early in the discharge cycle from the normal 1.2V to 1.05V or so. This can cause some appliances to believe the cell is flat, because a normal NiCad is very nearly flat when its terminal voltage has fallen this far. A voltage depressed cell, however, can actually deliver about the same amount of energy as it ordinarily would.

Genuine memory effect is very seldom seen, and only occurs in sintered plate NiCad cells, and is in fact cured by overcharging. Nickel metal hydride batteries are utterly immune to genuine memory effect, although they too can suffer from voltage depression.

Voltage depression can be cured by completely discharging the cells. However, completely discharging a whole battery is a bad idea, as I mentioned in my contribution to the 'humiliate Peter' festival a few magazines ago. Discharging a battery to 1V per cell before charging should be adequate to cure voltage depression, without the risk of cell reversal. But this need be done only seldom. Many people make a ritual out of discharging their batteries far more often than is necessary, and severely shorten the battery's life by doing it — a NiCad pack can last for only a few hundred complete cycles, but for many thousands of partial cycles.

Dead NiCad cells are a waste disposal nightmare, because of their cadmium content. There is to my knowledge no way to responsibly dispose of NiCads in Australia; my local hobby shop has a box full of dead cells they don't know what to do with. When the average consumer's mobile phone or laptop battery dies — probably early as a result of unnecessary cycling — it gets chucked in the bin, ending up corroding away in landfill. So the myth of memory effect and the associated fanatical deep cycling is not just a waste of money, but a significant environmental hazard. (Daniel Rutter, email)

THIS MONTH'S WINNER!

Thank you Daniel for this information, it's certainly something I was not aware of. I checked out the above website and found an extensive discussion on NiCads and NiMH batteries, all along the lines Daniel has succinctly reported. I certainly can't argue, as the qualifications of the contributors to the website seem very solid. If you're interested in NiCads and other battery types, I recommend you visit this site, which gives a lot of useful information.

However, as Daniel has pointed out, NiCads and NiMH cells do need to be deep-cycled occasionally to get the best operational time from an appliance. The manual for my Nokia 5110 mobile phone states: 'For good operation times, discharge the NiMH battery from time to time by leaving the phone switched on until it turns itself off.' It's interesting to realise the problem is due to overcharging, not partial discharging. As well, it could easily be fixed by using a charger that terminates the charge in response to cell temperature or voltage rise.

IR repeater

The next letter seeks information about an IR repeater system:

I have started building a wired infrared repeater, but I'm not sure about the design. My system uses an IR receiving subsystem which takes out the 40kHz carrier, with a 555 reinserting this carrier before the signal is sent to the IR LED. Unfortunately it doesn't work. Is there a way to build a simple repeater using a photodiode without the need to reinsert the carrier? Keep up the good work! (David Perry, email)

IR repeater systems, though simple in principle, are often more difficult to get going than you might think. I've experimented along these lines many times, so don't be surprised if you're having difficulties David.

You might find the March 1996 project 'Switch/Repeater for IR Remotes' useful. It covers the background theory for IR remote systems, and includes various circuits that use an OPIC sensor. These three-terminal devices respond to the carrier frequency, so it's quite feasible to build a simple repeater than doesn't need a 555 to reinsert the carrier.

You'll also find further information in the September '97 issue, in the project article IR to UHF Remote Control Converter. Other useful articles are July 1996, Infra-red (IR) Remote Volume Controller and December 1995, 4-Channel IR Remote Control. No one article will answer your questions, but each one will contribute something, such as using a photodiode, the output circuit to drive the IR LEDs and so on.

Magnetic field dangers

Over recent years there has been a lot of research into the dangers of electromagnetic radiation. We discussed this topic some years ago, in relation to living in proximity to high-voltage power lines. The following letter asks about the dangers of pulsed magnetic fields:

Can you tell me whether low frequency pulsed magnetic fields, such as those radiated by computer monitors, electric fences, pest controllers and so on are detrimental to human health? If so, at what levels do pulsed magnetic fields become of concern, and how can their strength be measured? (Herman Nacinovich, Gulgong, NSW)

I know very little about this, Herman. I do remember a friend of mine who had a heart pacemaker and worked in the switchyard of a power station. He found the magnetic fields from the transformers (50Hz) caused his pacemaker to stop. But other than that, I don't know. However, I'm sure a few readers will know something about this and will hopefully send me some information. Thanks for raising this interesting topic, and I look forward to some letters about it.

VNG clock receiver

Our next correspondent wonders whether the circuit of the Receiver for the VNG Clock (January '99) is a bit over the top...

Have a look at the circuit for the SW receiver for the VNG clock on page 57 (EA Jan '99). I reckon there are about 41 components (ICs, diodes, resistors, capacitors, relays, pushbutton switches) simply to switch between the five fixed frequencies. Is this electronics gone mad? These 41 components can be replaced by one 3-pole 5-position rotary switch. Why not? (Bruce Howard, Collinswood, SA)

After examining the article about the project, I tend to agree with you, Bruce. After all, the switch would simply need to select the two banks of tuning pots and the five LED indicators, with some simple diode logic (as in the circuit) to operate the relay driving transistor. Perhaps the designer (Peter Stuart) felt it was easier for constructors to purchase ICs and components than a suitable wafer switch. As well, the wiring is simpler, as the PCB does it all, and it could be that the 41 components are cheaper than a suitable switch. Or perhaps the designer didn't think of using a switch!

Car light problems

In December '98 I presented a number of letters describing problems with car lighting systems. I've since received a few more letters on this topic, including this one, which I think you'll agree presents a scenario that could be tricky to fault find.

I too have had problems with offset-pin automotive lamps that are made with the pins reversed to the standard. But sometimes these lamps can have other problems. I recently replaced the dual filament 21/5W stop/tail lamps in my car (Ford), and some months later I discovered the dual level backlight in the car radio would go dim when the tail lamps were switched off. I first suspected the radio, but I then found the stop lights were flickering, even though there was no pressure on the brake pedal.

I didn't connect the two problems until I discovered that the car radio light went dim when I operated the brake pedal. I figured there must be a short somewhere, so I first examined the trailer socket. Finding no problems there, I then suspected the wiring loom, a problem that has been known to occur before in Fords.

Finally, I decided to check the new lamps. Sure enough, one of them had an intermittent internal short between the two 'hot' bottom pins. A new lamp fixed the problem, but it raises the question again about the quality of lamps currently on the market. I have cars that are 32 years old, still with some of their original General Electric lamps. The current imports are junk in comparison. (Brad Sheargold, Dee Why NSW)

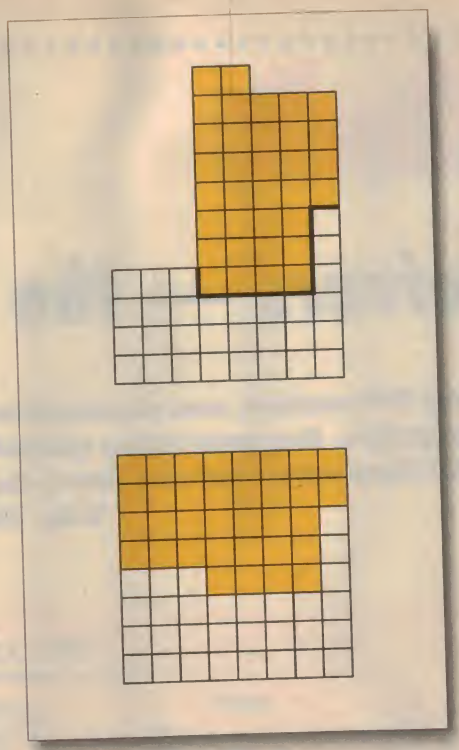


Fig.1: Solution to the March What?? question.

November's What??

A number of readers are not happy with the answer presented in December for the November What?? question. My recent absence has prevent me from following this up, but I'll do so as soon as possible.

What??

This month's question comes from a well-known contributor to this column: Harry Freeman, who is well regarded for his knowledge of telecommunications and radio transmission. Harry asks:

You have a signal source of 1V with an impedance of 75Ω, connected to a 50Ω load with a length of coax cable of unknown length. The question is, should you use 50Ω or 75Ω coax?

Incidentally, Harry has informed me of the recent death of Gordon Wormald, a long time contributor to this column and other sections of the magazine. Gordon also worked in telecommunications, at one time with Harry Freeman, and was highly respected for his technical knowledge. I'll certainly miss Gordon, as he made so many contributions to this column. My condolences to Gordon's family.

Answer to March's What

The solution is shown in Fig.1. ❖

Win this great Contrib of the Month Prize!

As an added incentive for readers to contribute to this column, we're now offering a valuable prize to the question judged most interesting, or the answer/response judged most informative, each month. The prize is a Mod-Col 38/54 high-res PAL colour video camera module from sponsor Allthings Sales & Services, with 450 lines of resolution, built-in digital signal processing, electronic shutter and auto gain control — valued at over $400!

Vintage Radio

TRF Receivers — the Last Hurrahs

Although many TRF receivers were described over the years for hobbyists, by this and other magazines, they were largely ignored by the major manufacturers after 1935. But there were a few exceptions: the midget AC sets, including Astor's 'Baby' (AR) and 'Football' (GR/GRP) models.

THE TERM 'TRF' (tuned radio frequency) usually conjures up one of two images. Firstly, the 'coffin box' or 'tin trunk' all-triode affairs of the 1920s, with up to four stages of triode RF amplification (battery or electric); and secondly, the two or three valve plus rectifier sets, in which a regenerative detector was used with or without an RF amplifier as the case may be.

There was a third category, which made a brief but significant appearance for a couple of years from 1929 to 1931. These were the straight multi-stage TRF's using pentodes. Performance was reliable and stable, and there was no need at all for reaction. After that, the superhet took over, although many if not most manufacturers offered both TRF's and superhets in their product range — for a short time.

It appears that the last of the TRFs were regenerative detectors manufactured in 1935, by Eclipse in particular and smaller firms indigenous to a particular capital city. These were cheap sets using a 6C6, 42 and 80 combination in a table cabinet. Healing had a three-valve battery set using a type 34 as the RF amp, a type 32 detector and type 33 output in a console cabinet.

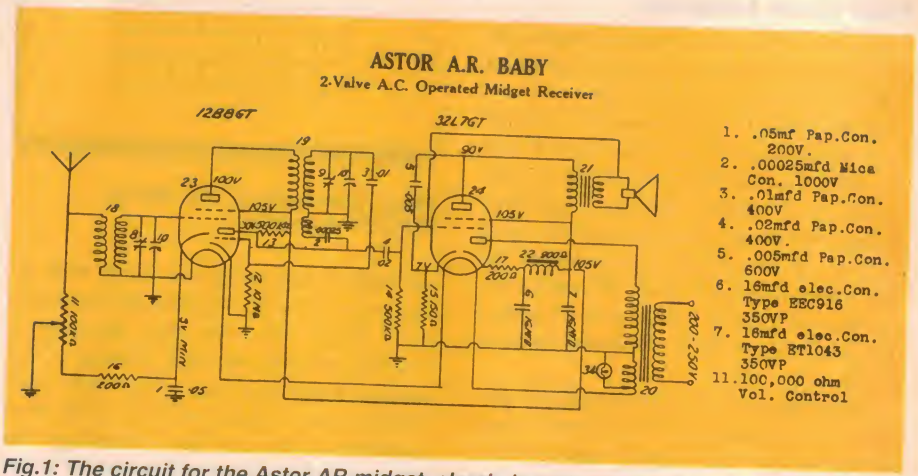


Fig.1: The circuit for the Astor AR midget, clearly based on a transformerless US design.

Why did they die?

Why did these very cheap TRF sets disappear? The answer to this is most likely to be the problem that non-technical members of the household had with managing the reaction control. Whilst regeneration was tolerated in the 1920s, there were steps taken to eliminate it — such as multi-stage tuning (which was no guarantee of stability, particularly with all triodes and individual tuning of the stages). Then came the all-pentode RF amplifiers as described above, which eliminated entirely the need for regeneration control while at the same time giving stable performance.

With merely a single stage of tuning, reaction or regeneration was vital if the set was to give any form of satisfactory performance. There was, it seemed, a market for budget priced sets for those willing to master the fine art of using the reaction control.

But prices were tumbling. Between £16 and £20, superhets were available which outperformed a TRF, and these superhets were not all that more expensive, particularly when performance was taken into account. Ergo, exit the TRF!

Fig.2: A sample Astor AR, showing its cabinet and chassis (courtesy HRSA member Les Jolly).

Renaissance in 1939

What if a two or three valve TRF could be produced without the need for regeneration, and it could be made cheaper still, with satisfactory performance and marketed as a 'second set'? Astor did just that with their 'Astor Baby' model AR. (The equivalent Monarch was the 'Monarch Minor' model AR.)

by Roger Johnson

Fig.3: From left to right are shown a National ALP, an Astor GR (without name badge) and a Healing 300E.

This was a most unusual circuit indeed, for it contained two hitherto unheard-of valves in Australian radio production. They were dual purpose types: one was the 32L7GT, which combined a half-wave rectifier and power pentode in the one envelope, while the other was the 12B8(GT), a triode-pentode with separate cathodes (unlike the familiar 6F7 which had one cathode to supply both sections).

These tubes are of American design, and as with types such as 50L7-GT, 25A6 etc., the heaters were designed to be series connected and run direct from the 117V AC mains. Rectification was direct from the mains, so that the tiny superhets were literally transformerless. (This was the original concept of the Astor Mickey, designed by the Hazeltine corporation in 1933.)

The AR circuit

The circuit for the Astor AR is reproduced in Fig.1, taken from the *AORSM* for 1939 (it was repeated again in 1940). An example, courtesy of HRSA member Mr Les Jolly is pictured in Fig.2.

The set is fairly obviously based on an American design. The heaters are in series, and as the maximum HT is 105 volts after rectification and filtering, HT would have originally been rectified direct from the 117V AC mains. Therefore, a simple transformer, more likely than not an auto transformer to simplify things again, was really all that was required.

For Australian conditions, a special transformer was wound having two secondaries of 44 volts (with a tapping for the dial light!) and a secondary of probably 115 volts, as the maximum rating for the half-wave rectifier in the 32L7 was 125V DC into the filter. This no doubt accounts for resistor R17 (200Ω) prior to the first filter capacitor. The 900Ω choke shown in the circuit is the field coil of the 5" EM speakers, also used on some of the later Astor 'Mickey' sets.

Apart from the low voltages, unfamiliar to Australian servicemen in 'electric' sets, the output stage and the triode audio stage also differ in that each cathode resistor is unbypassed. This has the effect of negative feedback. Given that the gain of these stages would not be over powerful, negative feedback was a fairly bold move; no doubt an attempt to try and improve the frequency response, by boosting the extreme ends of the audio response curve.

The RF section is worthy of note. The pentode stage of the 12B8 operates as a normal pentode in which gain is controlled by the 10k cathode degeneration pot (shown in the circuit as a 100k, which is most unlikely), which simultaneously shunts the aerial. The RF stage is coupled to the triode detector in the normal fashion, whereupon grid leak detection follows. However a 0.01uF (10nF) grid capacitor followed by a 10 meg grid leak is quite radical. Even for audio frequencies, the usual combination was 1nF/10MΩ, or 10nF with a 1MΩ grid leak. With a strong signal, input overload and distortion would have to be apparent.

Regeneration is used, but it's fixed regeneration around the triode via the 250pF capacitor from its plate, feeding the additional winding on the RF transformer.

Much care would have to have placed in the design of the coils, so that the set would not begin to oscillate at the very top of the band. As one tuned down in frequency, the amount of regenerative feedback decreases (recall the article on aerials, coils and the whole damned thing?). To compensate for this, the primaries of both coils are of the high impedance type, which increases the coupling at the lower frequency end of the band.

Post-war TRFs

The same philosophy of a reliable and adequate three-valve budget priced mantel, often referred to as 'miniature' or 'midget' sets, extended into the post-war period. Healing and Radio Corporation were the major players. Radio Corporation by this time controlled the 'Astor', 'Monarch' and 'Peter Pan' brand names, and in Adelaide they also owned the 'National' brand.

However the post war models were of a vastly different design concept. They used a variable-mu duo diode pentode as a reflex RF amplifier and audio amplifier, followed by an output valve and a conventional full-wave rectifier giving the 165 or so volts, so that the valves were operating at something like more familiar conditions.

The Healing 300E

This midget was housed in the same cabinet and used the same chassis as the 400E and the 401E, a straight four-valve superhet with a couple of unorthodox design ideas. Released in 1946, the cabinet colours were brown, cream or maroon bakelite, all of which are collectable.

The first stage of the 300E (Fig.4) is an EBF2-G in which the pentode section is firstly an RF amplifier. This is in turn transformer coupled to the second tuning stage. However, the difference here is that the tuning is in the primary or plate circuit, and the tuning capacitor is isolated from the HT by a 0.1uF paper capacitor.

The secondary is then fed to the diode(s), where the signal is demodulated and the audio voltage appears across the 50k filter and 1M audio load resistors. This audio

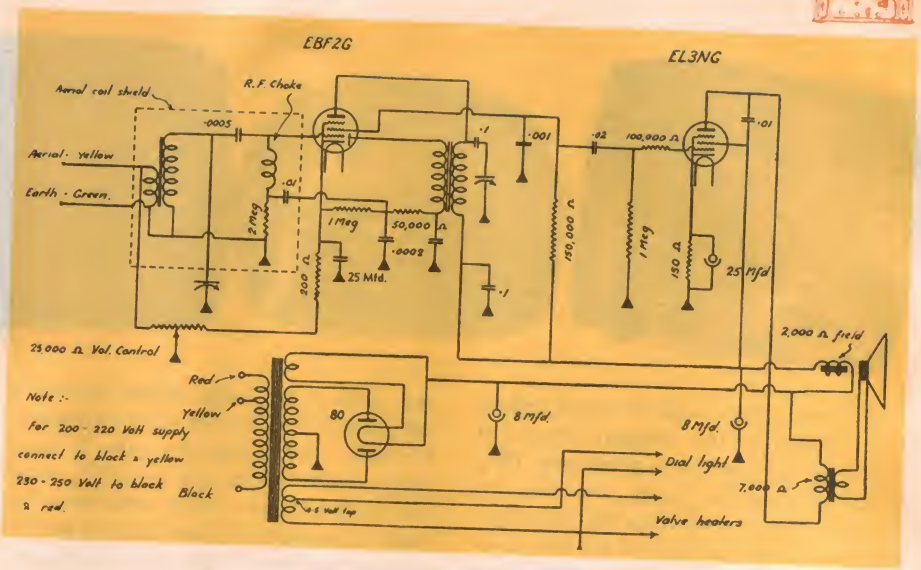


Fig.4: The circuit for the Healing 300E, chosen because of its unorthodox tuning and 'screen reflexing' system.

signal is then fed back to the signal grid. Any RF is blocked by an RF choke, and a 2M grid leak completes the circuit. The audio is isolated from being bypassed via the aerial coil, by a 500pF mica capacitor.

Thus amplified, the audio is fed to the output valve type EL3NG from the screen of the EBF2. For audio purposes, the screen acts as the anode of a triode, and the screen dropping resistor becomes the 'anode load'.

There was a good reason for this. With an anode load resistor in the plate circuit, the plate voltage would be considerably reduced, and so too would the screen need to be likewise reduced. This would have markedly lowered the stage gain, compared with the approach chosen.

The remainder of the circuit is very conventional as you can see, with a type 80 rectifier and a 5" EM speaker with a 2000 ohm field coil doubling as a filter choke.

The Astor 'Football'

The Astor 'Football' model GR, or GRP is probably the most prized amongst collectors of these baby TRFs, but it probably wouldn't matter if it was a TRF or a superhet! They were available in powder-puff blue, green, ivory, red, brown and black bakelite, and had a specific dial for each state.

For those who have yet to recognise one, a sample is shown in the centre of Fig.3 and you can see why they were called the 'football'. The 'GR' used a 5Y3-GT rectifier, while the 'GRP' used a 6X5-GT.

There should be an Astor name badge above the dial made of clear plastic, and pressed into two small mounting holes in the cabinet using locating pins moulded into the badge plastic. However not many examples have survived with the name badges intact, and those that are complete fetch a very high price indeed.

The Monarch equivalent was the model CLP, and the circuit was identical, although the cabinet was the same as the 'AR'.

The circuit for the Astor GR/GRP was a far cry from the Healing 300E; the only similarity being a reflexed RF/audio. This time the circuit uses the lower gain 6G8-G driving the less sensitive 6V6-GT. Back bias is used exclusively, and volume control is via the back bias to the grid of the 6G8-G. A PM speaker is used, and filtering is via a 5kΩ resistor and two 16uF electrolytics.

The reflexed audio is developed using the 'anode' method as described above, and indeed the voltages using a 1000 ohms per volt multimeter were merely 50V on the plate and 30V on the screen. Using a DMM (or an old VTVM) these figures would probably be something like 70V and 50V respectively. Even so, the gain of the tube under these operating conditions would be way below par.

Fig.5: The chassis of an Astor GR. With only three valves and no IF transformers, it is very compact.

National's ALP

This little set was available with or without an alarm clock switch, and therefore was clearly designed to be a bedside radio. The circuit is the same as the Astor, with the exception that it uses an EL33 output valve and the back bias resistors are modified accordingly. It was also available without the clock option.

Set performance

There are definite limitations to these baby sets, and if one were living under the shadow of a transmitter, life would be pretty difficult. However, with this restriction removed, performance depends as much as anything upon the length of the antenna and careful alignment. A 12" piece of wire, sufficient for a decent five valver, is inadequate. Only the stronger stations are heard with the volume full on.

On the other hand, 12 feet of antenna overloads the front end. The optimum appears to be about 3 or 4 feet.

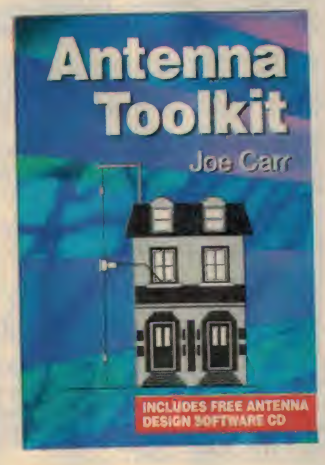
Compared against the Astor football, the National and the Healing, all aurally tested under very similar conditions, the Astor two-valve 'AR' was marginally better. The Astor and equivalent three valvers had a very smooth volume control, and a 'clean' sound.

No doubt the Healing's performance is due in no small way to the provision of tuning slugs in each of the coils. The bottom end of the band could be peaked as well. With the volume full on, all of the local stations are separated and there is plenty of audio into the bargain. If anything, the Healing tended to slightly overload and 'clip' at maximum volume, and the tuning control has a detuning tendency, requiring slight tuning adjustment for different settings of the volume control.

However, for all that, these sets did do the job for which they were designed, and did it rather well. They are worth collecting from a technical point of view, as well as the desire merely to own a 'football'. ❖

New Books

Antenna design guide



ANTENNA TOOLKIT, by Joe Carr. Published by Butterworth-Heinemann (Newnes imprint), 1997. Soft cover, 233 x 157mm, 215 pages. ISBN 0-7506-3755-2. RRP $69.00.

In these days of pre-designed and commercially packaged receivers and transmitters, one of the main areas where radio amateurs and shortwave listeners can still achieve considerable success 'building their own' is antennas. This book from well known US radio amateur and author Joe Carr K41PV aims to help ensure this success, by providing a sound, practical and easy-to-follow guide to the design of proven HF antenna configurations.

It starts with the theory of propagation and antenna basics, and works its way through Marconi and other unbalanced antennas, to dipoles and doublets, limited space antennas, loops and arrays. Later chapters then deal with important topics such as impedance matching, instrumentation and measurements.

The text is in Mr Carr's usual very accessible style, with a good balance between theory, maths and practical considerations. As an added bonus there's again an accompanying CD-ROM, with a collection of very useful Windows-based antenna CAD programs arranged to complement each book chapter. The CD also provides a copy of VOACAP, the very useful freeware HF propagation package developed by the US Government's Voice of America organisation.

If you're interested in designing and building your own HF antennas, for either shortwave listening or amateur radio work, it would be a very handy reference.

The review copy came from Butterworth-Heinemann Australia, PO Box 251, Port Melbourne Vic 3207. (J.R.)

Servicing computer printers

TROUBLESHOOTING & REPAIRING COMPUTER PRINTERS, by Stephen J. Bigelow. Published by Tab Books, 1996. Soft cover, 185 x 235mm, 472 pages. ISBN 0-07-005731-1. RRP $44.95.

Computer printers probably work harder than any other part of a computer system, and being an electro-mechanical device are more likely to break down. A book such as this one is therefore likely to find a good market, as it not only covers servicing and repairing printers, but also explains how they work. It also describes some servicing basics, on the assumption that the reader has little experience in electronics and servicing.

The prospect of someone without prior experience reading this book and then tackling a printer repair could be asking for problems, but if you do have the required basic experience, this book should prove very useful. It covers the basic printing technologies (dot matrix, inkjet, thermal and laser) and also includes a chapter on printing problems with Windows and Windows 95.

Other topics include troubleshooting techniques, servicing power supplies (perhaps a book in itself), and separate chapters on electronic and mechanical servicing techniques. Most of the material is generic, but specific printers are also described. Being a US publication, some of these printers might not be well known in Australia.

It's rather sparse on illustrations, and some of these are not up to the quality we've come to expect. There's also a range of flow charts, circuits and photos, but as this book is an update, some of the printers shown in the book are rather old. The book offers a companion disk, called PRINTERS, for US$20 but there's only a US address to obtain this.

The review copy came from McGraw-Hill, PO Box 239, Roseville 2069. (P.P.) ❖

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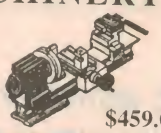

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Electronics Australia **is one of the longest-running technical magazines in the world. We started as *Wireless Weekly* in August 1922 and became *Radio and Hobbies in Australia* in April 1939. The title was changed to *Radio, Television and Hobbies* in February 1955 and finally, to *Electronics Australia* in April 1965. Here are some interesting items from past issues:**

50 years ago

April 1949

Our Tenth Birthday! With this issue, *Radio and Hobbies* celebrates its tenth birthday. After more than 15 years as Australia's leading technical magazine, *Wireless Weekly* gave way to our present journal, in April 1939.

Metal TV tube: A television receiving tube made largely of metal has been demonstrated in New York to a group of scientists. It is said to be the first successful tube of this type which can be manufactured on a continuous production basis. It is a 16-inch tube for direct-view home receiving sets.

Previous attempts to make tubes of this sort have been none too successful, because of difficulties encountered in attempting to join glass to metal in an airtight seal.

Phone via the Moon: American scientists are investigating the possibility of directing television and radio-telephone signals at the moon, in the hope that they will be reflected and be received thousands of miles from the point of origin.

It will be remembered that both in America and Australia, radar impulses have been aimed at the moon and received back at their source about 2.4 second later, proving the possibilities.

25 years ago

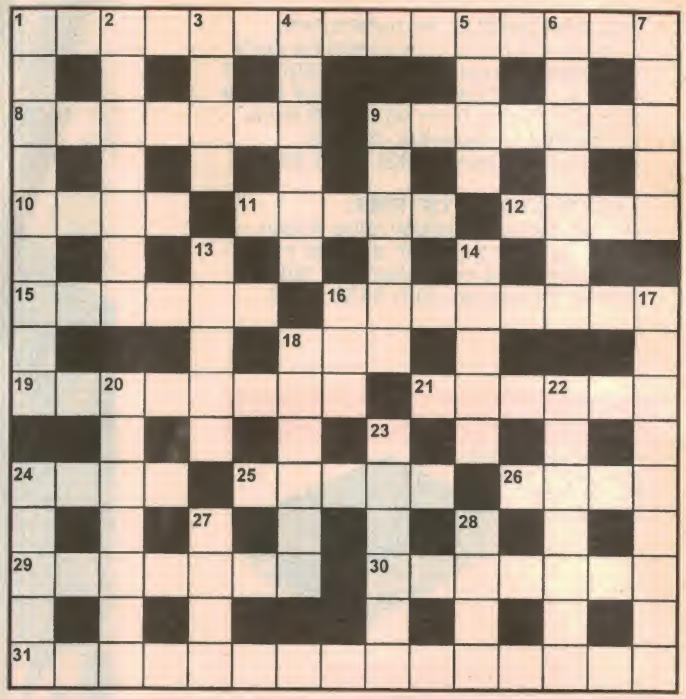
April 1974

Strong Support for FM on VHF: "FM on UHF? You're mad!" That was how Dr Lothar Rohde, partner in the large West German electronics company Rohde and Schwarz, reacted to the proposition put forward by the Australian Broadcasting Control Board, and ratified by the last Parliament. Dr Rohde felt so strongly about the subject that he flew out to Australia especially for the recent FM Inquiry.

At the Inquiry, Dr Rohde's evidence contradicted that of the Control Board's engineers and probably paralleled the (as yet) privately held views of the Inquiry Chairman, Sir Francis McLean. Observers expressed the view that the submission drove the final nail in the UHF coffin, and made it inevitable that the authorities find a way, somehow, to provide an FM service within the limits of the usual 88 - 108MHz band.

Revolutionary New IC for Signal Processing: A new semiconductor device for analog signal processing, with more than 100 times the computational power and speed of conventional components, has been developed by scientists at the General Electric R&D Centre in Schenectady, NY. Called a surface charge correlator, the new IC is expected to make dramatic reductions in the cost and complexity of detecting signals buried in noise. ❖

Crossword



Across

1 Problem time for computer industry. (4,3,8)
8 Radioactive element. (7)
9 Logical component. (3,4)
10 Speed. (4)
11 Type of load for testing. (5)
12 Brand of computer. (4)
15 Element used in doping. (6)
16 Measurement unit named after Swedish physicist. (8)
18 Formerly popular brand of spark plug. (1,1,1)
19 Greatly reduced image. (8)
21 Organisation providing data transmission. (6)
24 Hint in a puzzle. (4)
25 Unit of magnetic field intensity. (5)
26 Opposite of 5 down. (4)
29 Type of algebra. (7)
30 Prefix used in electronics. (7)
31 Cause of the problem in 1 across. (11,4)

Down

1 Rare-earth element. (9)
2 Abandoned a mission or operation. (7)
3 Adjust for optimum. (4)
4 Extremely dense element.(6)
5 Computer instruction to reverse entry. (4)
6 Class of radio operator. (7)
7 Important factor in car ignition timing. (5)
9 Setting in operational readiness. (6)
13 Teach; instruct. (5)
14 Former Australian brand of TV and radio. (5)
16 Word on computer keyboard. (3)
17 Device that is designed to beat time! (9)
18 Nature of Samsung, LG products. (6)
20 Famous French physicist (1736-1806). (7)
22 More than one spectrum. (7)
23 Given name of Einstein. (6)
24 Popular car alarm. (5)
27 Factor in chromosome. (4)
28 Transmit. (4) ❖

March's solution:

T	H	I	R	D	G	E	N	E	R	A	T	I	O	N
E		G		I		L		X		T		T		O
R	A	N	K	I	N	E		P	I	O	N	E	E	R
T		I		C		V		A		M		R		M
I	O	T	A		V	E	I	N	S		N	A	S	A
A		O		I		N		D		L		T		L
R	E	R	U	N	S		D	E	C	O	D	E	R	
Y				T		B	A	R		O				C
	K	I	N	E	T	I	C		A	P	O	L	L	O
S		N		L		N		Q		S		I		R
E	X	P	O		D	A	T	U	M		A	C	I	D
X		H		I		U		A		P		E		L
T	R	A	C	T	O	R		S	C	I	E	N	C	E
E		S		E		A		A		O		C		S
T	H	E	R	M	A	L	P	R	I	N	T	E	R	S

Electronics Australia's

Professional Electronics

Schlumberger's SiShell makes smart cards harder to crack

Nikon's E-beam lithography will allow sub-100nm chips

Next-generation 'Internet2' begins operation in the USA

Setting up and optimising your Internet connection, to ensure maximum speed

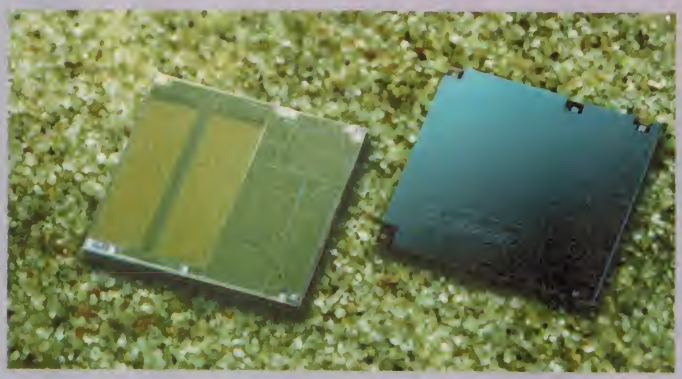
National Instruments' PXI-1025 MegaPAC: a complete and self-contained portable instrumentation & control computer based on PXI and CompactPCI...

highlights News

Breakthrough in smartcard security

SCHLUMBERGER HAS announced an innovation in smart card security, which physically protects the chip from unauthorized access attempts. This is claimed to provide the industry's most advanced solution to date against 'hacking' via physical probing, complementing current software and electrical protection measures to provide a comprehensive security chain for future card applications.

Chip technology has allowed card operators to take enormous strides towards defeating fraud and misuse. But tomorrow's smart cards will demand even greater protection, to support a host of new applications such as digital signatures and credentials, access rights, financial transactions via open networks, and the provision of higher and higher value services at lower cost.



Schlumberger's 'SiShell' technology completes the security environment for smart cards by applying a shield over the active surface which is structured in such a way that physical attempts at access threaten to destroy the chip. This does not affect functionality in any way, but effectively stops attempts at hacking by mechanical or e-beam probing, or affixing internal connections. Such techniques are not easily accessible today, but they may start to be considered by fraudsters as society begins to replace money and traditional proofs of identification with electronic tokens, digital signatures and biometrics, and the stakes are raised to very high levels.

SiShell places a significant additional barrier in the path of potential fraudsters. The active surface of a chip protected by SiShell is covered completely with a silicon cap, which is sealed at the wafer production stage. This technique is well understood by semiconductor manufacturers and is simple to perform during manufacturing. Once in place, subsequent attempts to gain access using chemical agents or mechanical means are circumvented. Extensive tests by Schlumberger and experts at a major semiconductor company have proved the effectiveness of the system.

The SiShell innovation has taken more than three years to perfect, and was originally started by Schlumberger partly as a result of input from its Automated Test Equipment division, which designs most of the world's e-beam probers and chip testers for use during semiconductor development and production. They helped Schlumberger's smart card designers analyze the future potential threats of illegitimately accessing the hardware, and provided expert knowledge in designing an efficient and cost effective protection, that can be easily deployed by semiconductor manufacturers.

SiShell is purely a manufacturing process and can be applied to all existing smart card devices and applications. The most likely first applications for this technology include pay TV, banking, health cards, and corporate/network ID.

Unit combines PC & entertainment centre

NEW ZEALAND FIRM The Internet Group (TIG) has launched a new satellite-linked consumer product that incorporates a standard PC, SatNet (high speed Internet access via satellite), a pay TV set-top box and DVD player. The product, called The SatNet Supersystem, comes in a black VCR-style case and boasts a DVD drive, a SatNet high-speed Internet card and a set-top box card that can handle both TV and a pay-per-view movie service. The movie service will be powered by a video server that TIG has picked up from Telecom NZ's defunct First Media cable business.

The Supersystem is now being released in Australia and costs about $2600 without a monitor. The main system box is designed to go where your TV goes.

The SatNet Supersystem will be sold with a range of monitors, ranging from 14" up to an impressive 31" monitor that's black, to match most televisions. The latter is priced at approximately $1300, similar to a normal TV of that size — but it's a high-quality VGA monitor as well as a TV. The set-top box card allows the user to view multiple channels picture-in-picture or to use a TV broadcast as a Windows desktop.

The SatNet Supersystem provides full entertainment control. Incorporated into the system is a wireless keyboard so users can surf the Internet at high speed (up to 7-10 times faster than with a standard modem connection), download files, send e-mails — all while watching a movie or TV. The PC will also record video to its own hard drive on a timer system.

The Internet Group has plans underway to broadcast TV using the former First Media hardware, later this year. The proposed TV network will have 12 channels of television and 30 channels of Pay-per-view movies.

TIG was formed in New Zealand in 1994 and opened their first Australian office in Sydney in early 1997. The company is a pioneer in South Pacific region with regards to using Internet satellite bandwidth technology. TIG's engineers have managed to split satellite transponder channels into 64kb/s streams for resale to some of its 40 ISP customers. The company has over 130Mb/s of active bandwidth in service throughout the Australasian market.

Modular power outlet success

AFTER A SUCCESSFUL launch on the local market and an Australian Design Award, a locally designed electrical socket outlet system seems set to generate a new export market.

The Elsafe Modular Socket Outlet is already having a major impact on the domestic office fit-out market, with more than double the original sales forecast being achieved since its launch just eight months ago. According to Elsafe's Technical Director, Phil Peach, the Modular Socket Outlet's revolutionary 'clip together' design is a significant advance on domestic style powerpoints, offering greater flexibility and substantial savings in configuring office fit-outs.

Mr Peach said the system, developed over two years with the assistance of industrial designer Sandy Richardson of Design Edge, was suitable for any office, but was proving especially popular in industries like banking, where large movements of personnel and equipment could occur over a two to three year period.

The Modular Socket Outlet includes safety features such as auto-switching, power-on light and optional flip lid. For more information contact Elsafe on (02) 9975 7422.

E-beam system will allow sub-100nm chips

JAPAN'S NIKON Corporation has announced its intent to develop and commercialize a reduction-projection electron beam lithography exposure system which is designed to permit semiconductor companies to achieve high productivity manufacturing of integrated circuits with sub-100 nanometre minimum pattern linewidths.

A sub-100nm design rule is predicted to be in industry full-scale production in 2006, and such a system would be capable of producing future high performance microprocessors and 16Gb (gigabit) DRAMs — capable of storing the equivalent of the amount of information that will appear in every edition of a typical daily newspaper for the next four years.

Nikon's e-beam technology is regarded as one of the leading candidates to replace today's optical lithography technology for semiconductor production. Optical systems have a natural limitation due to the wavelength of the light used. Electron beams are capable of achieving dimensions much smaller than those achievable by optical means.

To achieve higher manufacturing throughput, the Nikon system differs from traditional 'direct-write-method' electron-beam exposure systems in that circuit patterns on the mask are demagnified and projected onto a wafer while being scanned in the same fashion as today's optical scanning steppers.

Nikon's announcement is the result of feasibility demonstrations of this technique done in cooperation with IBM. This cooperative development effort will continue. Nikon intends to manufacture and market the lithography system. The technology has already been shown capable of achieving clearly resolved patterns with dimensions as small as 80nm. (Business Wire)

DES descryption challenge III broken

BREAKING THE previous record of 56 hours, Distributed.Net, a worldwide coalition of computer enthusiasts, worked with the Electronic Frontier Foundation's (EFF) 'DES Cracker', a specially designed supercomputer, and a worldwide network of nearly 100,000 PCs on the Internet, to win RSA Data Security's DES Challenge III in a record-breaking 22 hours and 15 minutes.

The worldwide computing team deciphered a secret message encrypted with the United States government's Data Encryption Standard (DES) algorithm, using commonly available technology. From the floor of the RSA Data Security Conference & Expo, a major data security and cryptography conference held in San Jose, California, EFF's DES Cracker and the Distributed.Net computers were testing 245 billion keys per second when the key was found.

First adopted by the US federal government in 1977, the 56-bit DES algorithm is still widely used by financial services and other industries worldwide to protect sensitive on-line applications, despite growing concerns about its vulnerability. RSA has been sponsoring a series of DES-cracking contests to highlight the need for encryption stronger than the current 56-bit standard widely used to secure both US and international commerce.

"As today's demonstration shows, we are quickly reaching the time when anyone with a standard desktop PC can potentially pose a real threat to systems relying on such vulnerable security," said Jim Bidzos, president of RSA Data Security, Inc. "It has been widely known that 56-bit keys, such as those offered by the government's DES standard, offer only marginal protection against a committed adversary. We congratulate Distributed.Net and the EFF for their achievement in breaking DES in record-breaking time."

As part of the contest, RSA awarded a $10,000 prize to the winners at a special ceremony held during the RSA Conference. The goal of this DES Challenge contest was not only to recover the secret key used to DES-encrypt a plain-text message, but to do so faster than previous winners in the series. As before, a cash prize was awarded for the first correct entry received. The amount of the prize was based on how quickly the key was recovered.

Atmel acquiring Motorola's smart card chip business

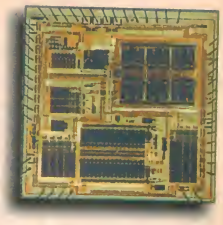
ATMEL CORPORATION of San Jose has signed a non-binding memorandum of understanding to acquire the Smart Information Transfer business of the Semiconductor Products Sector of Motorola, Inc., of Austin, Texas. The proposed transaction does not affect Motorola's other smart card-related businesses, such as its Worldwide Smartcard Solutions Division (WSSD), which will continue to provide total smart card solutions to a diverse range of industries.

Under the terms of the MOU, Atmel will acquire all of the assets of the SIT business and assume certain associated liabilities. Specific financial terms of the planned transaction were not disclosed.

"This planned transaction will establish Atmel as one of the world's leaders in the Smart Card IC industry, complementing Atmel's existing Smart Card expertise", stated George Perlegos, Atmel's president and CEO. "In addition, Motorola's SIT business will provide Atmel with a broad array of technologically advanced products, including their advanced security features and outstanding design and engineering capabilities. Combined with Atmel's established expertise, SIT's advanced technological competence will expand our existing technology base and have significant market potential."

Founded in 1984, Atmel Corporation is headquartered in San Jose, California with principal manufacturing facilities in Colorado Springs, Colorado, Nantes and Rousset, France and Heilbronn, Germany. Atmel designs, manufactures and markets on a worldwide basis advanced logic, mixed-signal, nonvolatile memory, and RF semiconductors. ❖

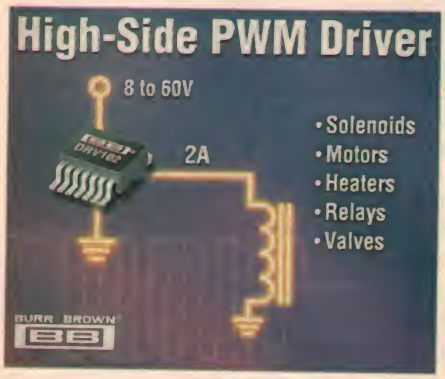
Solid State Update



Keeping you informed on the latest developments in semiconductor technology

High-side PWM power switch

Burr-Brown's new DRV102 is a complete, high-side power switch employing a pulse-width modulation (PWM) output, which conserves power and reduces heat rise, resulting in higher reliability. Its rugged design is optimized for driving electro-mechanical and thermal devices such as solenoids, valves, relays, heaters, and lamps.



The DRV102's wide range of power driver applications include on/off control (fully open or closed) and proportional control (variable opening or position for partial flow) in medical analysis, industrial control, and factory automation equipment. It can be set to provide a strong initial solenoid/valve closure, automatically switching to a 'soft' hold mode for power savings. Duty-cycle can be controlled by a resistor, an analog voltage, or digital-to-analog converter for versatility.

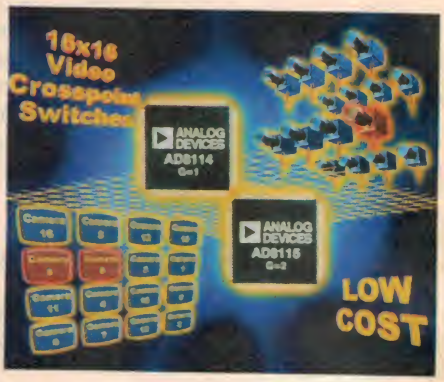
The DRV102 features a pulse-width modulator, internal 24kHz oscillator, digital input, external delay and duty cycle adjust, thermal shutdown, and over/under current detection. An output flag indicates fault conditions. Other features include high output drive (2.4A), wide supply range (+8V to +60V), and full protection from load faults and overheating.

For more information circle **272** on the reader service card or contact Kenelec, 2 Apollo Court, Blackburn 3130.

16 x 16 video crosspoint switches

Analog Devices has announced the latest additions to its family of high-speed switching solutions — the AD8114 and AD8115 low-cost, 16 x 16 video crosspoint switches. The on-chip integration in these devices saves design time and enhances performance with 256 switch points, 16 output amplifiers and control logic, all in a tiny LQFP package. The switches are claimed to offer the most cost-effective way to build large arrays with wide bandwidth.

The AD8114 (gain of +1) and AD8115 (gain of +2) include 16 independent input buffers and output buffers which can be placed into a high-impedance state for parallel connection of crosspoint outputs, so that off channels do not load the output bus. They



operate on voltage supplies of +/-5V while consuming only 70mA of idle current. The channel switching is performed via a serial digital control (which can accommodate 'daisy chaining' of several devices) or via a parallel control, allowing updating of an individual output without re-programming the entire array.

The AD8114/115 offer a -3dB signal bandwidth greater than 225MHz, 0.1dB flatness up to 50MHz, and channel switch times of less than 60ns to within 0.1% settling. They also feature -72dB of crosstalk and -95dB isolation at 5MHz, as well as differential gain and differential phase of better than 0.05% and 0.05°, respectively.

For more information circle **273** on the reader service card or contact Analog Devices, Suite 4/1621 Point Nepean Road, West Rosebud 3940.

Mobile AMD-K6-2 runs at 333MHz

AMD has announced availability of the low-power Mobile AMD-K6-2 processor family for notebook computers. With a top speed of 333MHz, they are claimed to be the highest clock speed mobile processors available. The Mobile AMD-K6-2, also available at 300 and 266MHz, is the first PC processor for notebook computing that uses AMD's innovative 3DNow! technology to offer excellent 3D graphics and a superior visual computing experience to mobile PC users.

The Mobile AMD-K6-2 processor supports existing low-cost Socket 7 notebook designs, as well as Super7 platforms that offer advanced features — including a high-performance 100MHz frontside bus and

AGP graphics. Mobile Super7 chipset support is available from leading third-party suppliers including ALi and VIA.

Toshiba, the world's leading notebook PC manufacturer, is using the Mobile AMD-K6-2 in its new Satellite 2520 with 64MB of RAM, a 12.1" active matrix display, 4.3GB hard drive and 24X CD-ROM drive.

The Mobile AMD-K6-2 processors operate at a core voltage of 1.8V and dissipate less than 8W of power running typical applications. This allows system vendors to offer notebooks with longer battery life and smaller form factors while retaining excellent performance.

For more information circle **271** on the reader service card or contact AMD Australia, Level 14, 33 Berry Street, North Sydney 2060.

PNP transistors cope with 500V

Developed to meet the demands of high-voltage applications ranging from high intensity discharge lamp driving to telecom system switching, the latest PNP transistors from Zetex can handle a peak collector-emitter voltage of 500V.

Two different formats of the new device have been made available, the FZT560 in a SOT223 package and the FMMT560 in the far smaller SOT23 package. With both types offering the same high voltage performance, respective power dissipation figures are 2W and 0.5W.

As a guide to related current handling capabilities, both devices can support a peak pulse current of up to 500mA, and have a continuous collector current rating of 150mA. They also demonstrate a good gain characteristic: at a collector current of 50mA for example, typical h_{FE} is held at 80 for operation at the 500V peak voltage.

For more information circle **275** on the reader service card or contact REC Electronics, Unit 1, 38 South Street, Rydalmere 2116.

CCD signal processing IC

Burr-Brown's new VSP2100 is a complete mixed-signal processing IC which provides CCD (Charge-Coupled Device) signal conditioning and high resolution, 10-bit analog-to-digital (ADC) conversion, for use in capturing images in digital camera (video and still) and PC camera (videoconferencing, Internet video, and security cameras) applications.

The VSP2100 offers low voltage, low power operation and excellent low noise performance for connecting a sensor input to a digital signal processor. The low voltage (2.7V to 3.6V) and low power (160mW at 2.7V) make it ideal for small size and portable equipment by extending battery life, while the low noise provides improved picture quality.

The VSP2100's primary CCD channel offers correlated double sampling (CDS) to extract the video information from the pixels, 0dB to +34dB gain range with digital control for varying illumination conditions, and black level clamping for an accurate black reference. The stable gain control is linear in dB and the black level is quickly restored after illumination changes. In addition, an on-chip 10-bit digital-to-analog converter allows analog control voltage for iris control. Other features include 27MHz conversion rate and no missing codes.

For more information circle **276** on the reader service card or contact Kenelec, 2 Apollo Court, Blackburn 3130.

Tiny buck/boost controller IC

Vishay Siliconix has released a fully integrated programmable controller IC providing DC-DC conversion efficiencies upwards of 93% in cell phones and other mobile communications devices, but requiring a footprint area of just 32 x 19mm on a single sided PCB. The new Si9165BQ combines conversion circuitry with on-board N- and P-channel power MOSFETs in a surface-mount TSSOP-20 package.

With an input range of 2.7 - 6V, the Si9165BQ can be programmed to function either as a synchronous buck or as a boost converter, stepping power down to 1.3V or boosting it up to 6V. It can provide power to the signal processing circuitry and power amplifiers in digital cell phones, portable phones, PDAs, and other systems powered by single-cell lithium ion batteries, and is capable of delivering up to 600mA of output current at 3.3V.

It is claimed to be the first device of its kind to operate at frequencies up to 2MHz, which allows designers to use smaller magnetics and reduces output capacitance. When used with the new low-profile IHLP2516 inductor from Vishay Dale, a complete converter solution has a height profile of just 2mm. The total volumetric space required for all circuitry is just 1.2cm^3, one of the smallest available for this level of performance. The chip-inductor combination likewise reduces the output capacitance requirement to less than 10uF, with peak-to-peak output ripple as low as 10mV.

A synchronization feature allows designers to set the converter to run at a defined frequency, which prevents any interference with sensitive carrier, processing, and intermediate spectrum frequencies.

For more information circle **277** on the reader service card or contact distributor Braemac, 1/59-61 Burrows Road, Alexandria 2015. ❖

Computer

News & New Products

Integrated portable CompactPCI/PXI computer

National Instruments has announced what is claimed as the world's first completely integrated portable computer based on CompactPCI and PXI specifications. The PXI-1025 MegaPAC, which integrates a flat-panel LCD, keyboard, pointing device and CD-ROM drive, is said to bring a higher level of modularity, ruggedness, and capability to portable computing and instrumentation.

National Instruments developed the PXI-1025 MegaPAC together with Dolch Computer Systems, to combine the rugged modular architecture of CompactPCI and the instrumentation extensions of PXI with a proven portable platform. Shock-mounted construction, a more compact 3U size, integrated timing and triggering, AC and DC power options, a fold-away keyboard, and seven PXI/CompactPCI expansion slots make the unit an extremely capable and versatile portable computer for the most demanding field test applications.

The PXI-1025 MegaPAC uses a PXI embedded computer module available with Pentium processors running standard Windows NT and 98 software. With the embedded computer in the PXI-1025, users enjoy integrated connections to the built-in keyboard, pointing device, and CD-ROM; connections for external pointing devices and keyboards; integrated connection to the built-in flat-panel SVGA display; external connection for auxiliary SVGA monitors and displays; USB, serial, and parallel ports; a 4GB hard drive and floppy drive; a GPIB port for instrument control; and an optional Ethernet port for network connection.

For more information circle **160** on the reader service card or contact National Instruments Australia, PO Box 466, Ringwood 3143.

Faster photo printer from Canon

Canon has released the BJC-7100, a fast seven-colour printer capable of accurate photo-quality printing and laser crisp monochrome output. The BJC-7100 supersedes the BJC-7000 and offers Canon's exclusive Plain Paper Optimised Printing (P-POP) to ensure outstanding water resistance and sharper details on plain paper. Its speed combined with professional colour output are claimed to make it the ideal personal printer for business, designers and SOHO users.

For the competitive price of $599 the BJC-7100 comes standard with a PhotoRealism cartridge (BC-62e), a black and ink optimiser cartridge (BC-60) and a cartridge storage container; an optional colour cartridge (BC-61) is also available. Additional features include the ability to print full bleed A4 with special A4+ paper; a built-in cut sheet feed tray able to hold up to 130 sheets; and the ability to accept stocks up to 550gsm via the manual feed slot.

The BJC-7100 can produce up to 8ppm in monochrome and up to 5ppm in colour, making it the fastest printer within Canon's Bubble Jet range. In quality photo printing mode, the BJC-7100 is claimed to be three times faster than conventional ink jet printers. It uses an advanced print head design that incorporates up to 1,088 nozzles, capable of up to 100,000 drops per second. The print head system also uses a dramatically reduced drop size and greater dot precision, which combine to produce smoother, sharper images and text at up to 1200 x 600dpi resolution.

The BJC-7100 is available from Canon dealers.

Low cost DV camcorder editor

Lako Vision has announced the Australian release of Canopus DVRaptor for Windows 95/98 and Windows NT. The DVRaptor is a DV and i.LINK PCI card with a high performance software DV codec and is the first DV editing card to provide full-screen, full-motion video preview and seamless batch capture. It offers a low cost solution for video enthusiasts and multimedia professionals who want to get the most from their DV cameras and decks.

DVRaptor lets users easily capture digital video and still images from DV camcorders directly to the hard disk. Users can capture, edit, and output without any loss in video quality. The DVRaptor ingeniously uses the DV camera's hardware codec to provide real-time preview and output composite and S-video, giving users high-end experience while fully using your video edit-

ing hardware. Video can be monitored in real-time while it is being captured or recorded through the i.LINK. The video can also be previewed simultaneously on a video monitor, something totally exclusive to the DVRaptor.

DVRaptor reflects the strong engineering and product stability and reliability found in Canopus' professional level video product, DVRex-M1. Its new PCI bridging technology ensures high compatibility and flawless operation in any Windows environment, resulting in smoother workflow and fewer hardware conflicts. A key feature found in the DVRex which has been incorporated into the DVRaptor is the ability to capture up to 180 minutes of video into one AVI file, overcoming the 2GB file limit of AVI for Windows. No other entry-level DV editing product features a greater than 2GB AVI file capture limit.

The Canopus DVRaptor is available now from Lako Vision for an RRP of $1675. This includes Canopus Raptor Video and Raptor Navigation software, and the full version of Ulead MediaStudio Pro 5.0. System requirements include a Pentium 200MHz MMX or higher, Windows 95/98 or NT, 32MB RAM or more, a video rated hard disk drive, and a VGA card that supports hardware DirectDraw overlay.

For more information circle **161** on the reader service card or contact Lako Vision on (03) 9852 7444.

Ultra2 SCSI cards

Adaptec has introduced two new Ultra2 SCSI cards. The 2930U2, designed for the desktop PC, is an affordable 80MB/s solution with connectivity to all SCSI peripherals. The 3950U2 is Adaptec's first 64-bit PCI SCSI card and doubles Ultra2 throughput, providing 160MB/s performance to enterprise servers.

The 32-bit PCI, single-channel 2930U2 SCSI card is Adaptec's lowest priced Ultra2 SCSI card, and is designed to connect common desktop peripherals such as hard disk drives, removable drives, CDR and DVD drives. Because the 2930U2 incorporates Adaptec's SpeedFlex technology, 80MB/s throughput can be realised regardless of the kinds of peripherals being used. Without SpeedFlex, users concurrently running Ultra2 Low Voltage Differential (LVD) hard disk drives and common (non-Ultra2) desktop peripherals cannot achieve this maximum performance. No other SCSI card on the market has the combined connector design and SpeedFlex-like technology which make this possible.

The AHA-3950U2 SCSI card is Adaptec's highest performance host adapter and the company's first 64-bit PCI Ultra2 SCSI card with two channels. This Ultra2 SCSI card is designed for large throughput server applications where clustered servers, large database servers or CD-ROM servers need more channels to support larger numbers of storage devices.

The 3950U2's two independent SCSI channels offer a combined data transfer rate of 160MB/s. The 64-bit PCI interface maximises the capability of the dual SCSI channels by increasing the throughput on the PCI bus to a maximum of 266MB/s. The combination of Ultra2 technology, 64-bit capability and two channels reduces the possibility of a system bottleneck in demanding applications such as video editing, external RAID subsystem connection, database applications, or clustering environments.

For more information circle **162** on the reader service card or contact Adaptec distributors Agate Technology, (02) 9878 4688; Anabelle Bits, (02) 9384 8000; or Tech Pacific, (02) 9381 6000.

National Instruments releases LabVIEW 5.1

National Instruments has released version 5.1 of the LabVIEW development environment, the world's most popular application development enviromnent for measurement and automation. LabVIEW 5.1 improves application development by streamlining the creation of Web-enabled applications. The new modular application architecture lets users create smaller executables to gain greater system performance and decrease memory usage. LabVIEW 5.1 also extends its use of ActiveX (COM) technology to seamlessly integrate the maths and interactive analysis capabilities of The MathWorks MATLAB and National Instruments HiQ.

Using new built-in Web tools in LabVIEW 5.1, users can publish VI front panels on Web pages in seconds with no programming required. With the new DataSocket technology users can also share data quickly with other Internet-enabled applications without worrying about networking protocols or data formatting.

A few simple VIs make it possible to publish and receive data using any number of clients, including LabWindows-/CVI applications, Visual Basic applications, Java applets, and Web browsers.

LabVIEW 5.1 applications are now modular components (DLLs), similar to text-based programming languages such as Visual Basic. With this new architecture, users now can create smaller executables to decrease memory usage and improve system performance. LabVIEW 5.1 also continues to integrate new ActiveX (COM) technologies, first introduced into LabVIEW in 1996, by now supporting the ActiveX event model.

For more information circle **163** or contact National Instruments Australia, PO Box 466, Ringwood 3143.

Video receiver card

With the TerraTV+ Receiver System, you will make the next step into a new multimedia future. It allows watching your favourite station, reading videotext, viewing selected Internet sites and taking advantage of Intel Intercast Technology to view selected Internet sites currently being transmitted together with the TV signal. Required software is included.

The TerraTV+ is claimed to be very easy to install, and the 32-bit applications ensure a completely stable, flicker-free picture on your PC monitor. You can display one large picture up to a size of 768 x 576 pixels, or display up to 64 smaller images at one time.

Connecting your video camera or VCR allows you to use the included Video Studio 3.0 software for all sorts of exciting video editing, polish home videos with the audio dub function, even hold video conferences via the internet.

For more information circle **164** on the reader service card or contact Moore Music, 219 Napier Street, Fitzroy 3065.

Brother's new MFC is laser based

Leading office technology innovator Brother International has released a new seven-in-one Multi-Function Centre (MFC), the MFC-6650MC, which employs a laser printing engine for higher print quality.

Each of the seven features found on the MFC-6650MC is highly advanced, yet extremely practical. The unit successfully integrates a laser printer, digital laser copier, laser fax, PC fax, high resolution scanner, telephone features and a Message Centre. The laser facility offers a higher printing speed (6ppm), a higher quality result (600 x 600dpi), and lower running costs when compared to other printing technology. This makes it more suited for use in true business applications, says Brother.

The MFC-6650MC's Message Centre allows users to access faxes and messages from a remote location, thus allowing for business to continue even when the user is out of the office. Features include automatic fax forwarding, remote fax retrieval, a digital answering machine with 20 minutes recording time, paging to notify user when messages or voicemail is being kept on memory and the capabilities to change settings from a remote location.

For more information circle **165** on the reader service card or contact Brother International (Aust.), 7 Khartoum Road, North Ryde 2113.

New HP LaserJets

Hewlett-Packard Australia has introduced the HP LaserJet 2100 family of printers, designed for small workgroups and business professionals. The HP LJ2100 series replace the highly successful HP LaserJet 6P/6MP. The three new printers in the HP LJ2100 family are the first in their class to provide true 1200 x 1200dpi resolution at 10ppm print speed.

To support the rapidly growing number of mobile professionals, the HP LJ 2100 series printers feature a fast infra-red (FIR) port, providing an easy-to-use wireless printing solution for users of laptops, Palm Pilots, pagers and other innovative handheld devices such as the HP CapShare 910 information appliance. The printers also feature optional Postscript emulation, support for HP JetDirect Enhanced I/O (EIO) print servers and quality output across a wide range of media.

Other key features include a 66MHz processor; instant-on fuser, eliminating the wait required for warm-up time; and full networking support for Microsoft Windows 3.1 and 3.11, Windows 95 and 98, Windows NT 3.51 and 4.0, Mac OS, OS/2, and DOS-based environments.

The three new models comprise the LaserJet 2100, which has 4MB of RAM and an estimated street price of $1399; the LaserJet 2100M printer, with 8MB of RAM and PostScript emulation, and an estimated street price of $1499; and the LaserJet 2100TN, which provides the HP JetDirect EIO print server, an additional 250-sheet paper feeder and HP JetAdmin network-management software, with an ESP of $1799.

For more information circle **166** on the reader service card or call HP's Customer Information Centre on 1800-339-862. ❖

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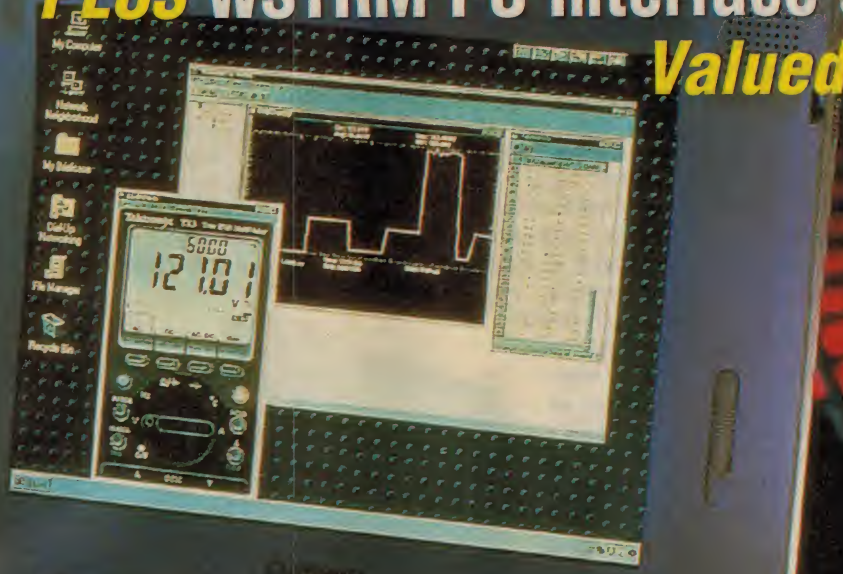
PLUS WSTRM PC Interface software packages!

Valued at $1,239 each Incl. tax



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That's right - subscribe or renew your subscription to *Electronics Australia* NOW, for 12 issues at the discount price of $55 (saving $16.40 on the normal cover price), and you'll be automatically entered into the draw to WIN one of six Tektronix TX3 Multimeters PLUS WSTRM PC Interface software packages valued at $1,239 each! (Including tax).

The Tektronix TX3 Multimeter is one of the new TX-DMM™ family of handheld true RMS digital multimeters. The new flagship DMMs simplify measurement tasks with an innovative design that provides an easy-to-use interface, one of the largest digital readouts available and Windows 95/NT compatibility. Also available (and included in the prize package) is the WSTRM PC interface package, consisting of an optically isolated PC interface cable and WaveStar™ for Windows 95 software. The WSTRM's remote capabilities convert the TX-DMM™ multimeter into a virtual instrument and data acquisition system.

Features of the Tektronix TX3 Multimeter:

- Extra large, dual numeric display with back light
- 1000V CAT III (IEC 61010 Compliant) Input Voltage Safety Rating
- Built-in K-type Digital Thermometer
- Diode check and continuity beeper
- Set-up menu for custom user defaults
- Auto and manual hold and ranging
- MIN/MAX/AVG/MAX-MIN recording with time stamp
- Relative (Delta) Measurements
- dBm and dB
- 4-20mA Process Loop Measurement with % readout
- Rugged Versa-Stand BOOT
- Traceable calibration certificate included
- Easy battery access without breaking calibration seal
- CE, UL, CSA safety certificates

The TX-DMM™ family is available through authorised Tektronix' distributors

New Products

Handheld audio signal generator

German manufacturer Neutrik Cortex Instruments has launched the Minirator MR1, a powerful handheld Analog Audio Generator combining true professional features and low cost. The first in a series of handheld test instruments under development by NCI, the Minirator generates a comprehensive set of audio test signals for rapid on-site performance checks, maintenance and repairs.

Despite its minimal size and weight (only 170g including batteries), the Minirator's advanced digital technology provides extremely high standards of performance and accuracy. Sinusoidal signals can be generated over the entire audio band from 20Hz - 20kHz, with levels ranging from -76dBu to +6dBu. A dedicated Polarity Test Signal is also provided.

In addition, White and Pink Noise signals with low crest factors and high repetition rates act as ideal signal sources for room acoustic measurements, frequency response equalisation and signal evaluation.

Signal connection is via a retractable three-pin XLR (fully balanced, floating, 200Ω) as well as a Phono/RCA plug (unbalanced, 200Ω) and all system information is instantly available on the Minirator's large character display. The operating system has been carefully designed to optimize simplicity (only three buttons!) and speed of use.

The Neutrik Minirator MR1 has a projected price of $280.00 plus sales tax.

For more information circle **241** on the reader service card or contact Amber Technology, Unit B, 5 Skyline Place, Frenchs Forest 2086.

DSO features 16 channels, long memory

Easy to operate for multichannel signal acquisition, the new Yokogawa DL716 is a Digital Scope with the advantages of both an oscilloscope and a recorder — high speed sampling and extended recording — that can measure waveform signals up to 850V DC + AC peak on up to 16 fully isolated channels. Using the long memory and/or an inbuilt 3.2GB hard disk drive, the DL716 can store data in real time for prolonged periods.

A large, 10.4" TFT colour liquid crystal display gives exceptional readability of waveforms and assists users when using the 'overall setup' menu to see and store configurations for all channels simultaneously, thus simplifying setups.

Seven different plug-in modules for the input channels can be combined in different configurations to enable a wide variety of measurement applications.

Several modules are available for the measurement of voltage, depending on whether the requirement is for high-speed high resolution, or high voltage high-resolution measurements. Using the 12-bit high resolution voltage input module, the DL716 can sample up to 10MS/s — as fast as many other oscilloscopes even though it has fully isolated inputs.

Also available are modules for strain and temperature measurement, plus a logic input module for 16 inputs at up to 10MS/s sampling rate. Two logic probes are offered with this module. In addi-

tion, a 32-bit extended logic input function is optionally available to allow the user to view signals on up to 16 analog and 32 logic channels at the same time.

The built-in thermal printer can be used to record signals in real time at up to 20mm/s or even monitor surge signals with frequencies up to several MHz when used in combination with the envelope function. A high level of PC and peripheral connectivity is provided by the standard inclusion of GP-IB and RS-232C interfaces for data transfer and instrument control, a Centronics port for connection to external printers with support for colour printing, plus a VGA interface to output waveforms to a large display monitor.

For more information circle **242** on the reader service card or contact Yokogawa Australia, Private Mail Bag 24, PO North Ryde 2113.

Satellite-tracked emergency beacon

An EPIRB (Emergency Position Indicating Radio Beacon), otherwise called an ELT (Emergency Locating Transmitter), is valuable emergengy protection for bushwalkers, explorers, lone mariners and other adventurers. When activated, they transmit an internationally recognised distress signal on designated emergency channels.

The new GME MT310 EPIRB from Dick Smith Electronics is designed for personal use. Each person aboard an ocean bound yacht for example, could have one attached to their life jacket. The same applies for pilots of small aircraft flying over remote locations, where it could simply be attached to a cord and hung around the neck of the pilot or kept in a secure pocket.

The MT310 EPIRB weighs only 175 grams and with the antenna down measures 155 x 66 x 25mm. Housed in a tough waterproof casing, it is powered by a lithium battery that has a storage life of up to 10 years.

When an EPIRB is activated, any aircraft flying in the vicinity will report the location of the signal via their radio to the nearest control tower. The EPIRB signal is also monitored and its position located by the COSPAS/SARSAT Satellite Tracking System. These signals are sent to the Australian Maritime Safety Authority in Canberra, whose job it is to notify local emergency authorities and give the position of the active EPIRB.

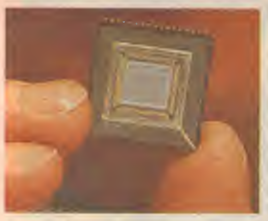
The GME EPIRB is available from Dick Smith Electronics stores throughout Australia for an RRP of $269 or via mail order by calling Dick Smith Electronics Direct Link on 1300 366 644.

V-I converters

The Penny & Giles range of voltage to current converters are designed to condition the voltage signal output from a range of displacement transducers to an industry standard current signal, in applications where long transmission distance is necessary or where a voltage signal would be corrupted by electrical interference.

Outputs are user adjustable between 0-10mA, 0-20mA and 4-20mA, and the units are housed in a rugged diecast aluminum box sealed to IP65. The converters are compatible with any potentiometric transducer, angular position transducers (APT), tilt sensors or DC LVDT.

For more information circle **244** on the reader service card or contact Control Devices, 1/150 William Street, East Sydney 2011. ❖



Silicon Valley Newsletter

Internet2 now under way

THE FIRST PHASE of bringing the new Internet2 online began officially on February 24, as more than 70 US universities and a dozen or so sponsoring corporations were able to log onto the 2.4Gb/s (gigabits per second) I-2 network. The high speed 'next generation' Internet will initially operate on a 13,000-mile network of fibre-optic cable. Some 100 universities and companies including Cisco Systems and Q-West have contributed financial and engineering resources to build the network, which will be 100-1000 times faster than the current global Internet.

Consumers and smaller businesses will not have access to the I-2 for quite some time, if ever. Only researchers at universities and corporations that helped build the network will have access. The rest of the Internet community will benefit also, but more indirectly. The benefits to consumers and business will be in the form of the incredible applications and services that will be developed using the power of the I-2 network and will be sold to companies serving the regular Internet community.

Using the Internet2, researchers in different parts of the United States will be able to jointly design complex 3D full-motion environments and other larger simulations. Hospitals can cooperate on diagnosing diseases, and university and corporate researchers can instantly access vast libraries of digital information that can be transmitted at the rate of a 15-volume encyclopedia worth of data in a single second. An entire 4.8GB two-hour DVD movie could be sent in just 20 seconds.

The final element in the initial I-2 network was put in place when Cisco Systems delivered a so-called 'golden router'. "The roll-out of the router was like driving the final golden spike on the transcontinental railway", said Stephen Wolff, executive director of Cisco's Advanced Internet Initiative operations.

Bell Atlantic to install IBM's home networking

IBM MAY HAVE a well-regarded home networking technology, but it doesn't have enough employees to install it. Home Director technology integrates personal computers, TV, telephones, the Internet and electronics in so-called home networks, in consumer homes.

However IBM has announced an alliance with Bell Atlantic, whose workforce of 3000 telephone system installers will be put to work to put Home Director in tens of thousands of new and existing homes on the US East Coast. Similar alliances are expected with telephone and cable companies in other parts of the United States.

IBM has a group of about 100 employees to install Home Director systems on the East Coast, far too few to handle the more than 10,000 orders IBM has already received for the product.

The deal also nicely compliments Bell Atlantic's push to provide asymmetrical digital subscriber line (ADSL) technology, which lets consumers receive information over regular copper phone lines more than 200 times faster than with conventional modems. It also lets customers make regular voice calls at the same time, without using a separate phone line. Bell Atlantic projects it will install ADSL lines for about two million customers this year.

With Home Director, up to seven PCs can share the same Internet connection, and security and lighting systems can be coordinated. "You can have a phone and computer plug-in in every room", said Mary Walker, IBM's general manager of home networking.

Movies on DVDs can be shown on any TV in the house with the system, and IBM plans to add technology so that music stored on PCs can be played on stereo systems throughout the house.

Installing Home Director starts at US$1000 for the basic wiring of four rooms.

Intel and Mattel have jointly developed a new line of PC-enhanced interactive toys, the 'Intel Play' range, which are expected to revolutionise the way children play and learn. The first two products are the X3 microscope, with inbuilt lighting and digital video camera, and the Me2Cam, a digital camera which comes with software for creative use of images. Each sells for US$99.

Flat TV still too expensive

THE MUCH ANTICIPATED wall-hanging flat TV will likely continue to be a pipe dream for the vast majority of consumers over the next five years. Not only are prices of flat screen TVs far too high for most consumers, the new technology is now facing stiff competition from HDTV sets — which, while not flat, offer far superior TV picture quality to traditional television sets. Many consumers, given a choice, will rather invest in the higher picture quality than in a flat medium.

The more sober forecasts of a slow moving flat-panel TV market highlighted the annual Display Works trade show

in San Jose, premier annual event for the flat panel display manufacturing industry.

A typical 40" FPD TV sells for around US$12,000, five times the cost of a CRT set of similar size, and three times the cost of a 40" HDTV set. "It's price, price, price, price, price and price. Why would anyone pay so much more for something that doesn't do anything better except that it's slimmer", said Thomas Striegler, a flat panel display consultant from San Jose.

The only area where flat displays have made significant inroads is in the computer market, including desktop systems, laptops and other mobile devices, and in the corporate conference room market.

Except for Philips, which has been aggressively advertising its flat screen TVs in the United States, major TV manufacturers are staying on the sidelines for now. Sony, for example, is waiting for manufacturers to figure out cheaper ways to build flat panel displays before getting into the market, said Sony technical service manager Dan King.

"As a normal, everyday customer, you and I are not going to pay for a flat panel today. We feel it's going to be a few years before these are really ready for consumers."

Ken Werner, editor of *Information Display* magazine, said just a few years ago, analysts were predicting cathode ray tubes would be close to obsolete by 2000. "That year keeps going further and further into the future", he said.

Chip sales recovering

MOMENTUM SEEMS to be building behind a recovery in the semiconductor market, as global IC sales registered a strong 11% jump in December to $11.3 billion. Sales for the entire fourth quarter rose 10% over the previous third quarter, according to the Semiconductor Industry Association. SIA president George Scalise said increased demand for PCs is boosting the recovery from the 30-month slump in computer chip sales. "Momentum appears to be building in the right direction", Scalise said, but declined to make a prediction for 1999.

"The No.1 trend is PC sales this year, which should rise nearly 25% to about 117 million units. This will be the first year when over 100 million units are sold", said Scalise, who served was chief operating officer of Apple Computer, following various positions at National Semiconductor, Maxtor, Advanced Micro Devices, Motorola and Fairchild Semiconductor.

Most of the growth is being spurred on by the growing 'must-have' consumer mentality towards Internet access at home and in the workplace. "Communications and computers — what we call information technology — consumes about 65% of IC sales", Scalise said. As recently as 1992, consumer electronics accounted for as much as 28% of chip demand. In 1998 that percentage fell to around 16%, explaining some of the problems being experienced by Japanese component manufacturers such as Sony and NEC, which are major electronics manufacturers and consume large quantities of ICs in their consumer electronic production.

While chip unit demand is picking up, prices will continue to fall, Scalise predicted. In fact, the SIA expects that average chip prices will continue to fall about 30% annually, as they have for 50 years. "That has been part of the way we have driven demand for products, part of the way we have generated volume to bring out the next generation of products", he said.

New IBM machine does 10 teraflops

ACCORDING TO IBM, it would take every person on the planet 62.5 years of continuous work on a hand calculator to equal the 10-teraflop calculations that its new supercomputer can perform in a single second.

The RS/6000-SP, cousin of the Deep Blue systems that defeated Chess grandmaster Gary Kasperov, is based on new Power3 processors that run up to two billion instructions per second. The IBM supercomputer has room for up to 1024 such processors.

IBM's computer sales declined 1.5% in the fourth quarter of last year, in part because many potential buyers delayed purchasing systems until the new series of SP machines was made available. IBM has also blamed a lacklustre marketing campaign for failing to generate additional sales of the RS/6000 supercomputers.

"We need to remind people what the system can do", said David Turek, director of technical strategy and business opportunity for IBM's computer-server division. IBM also is counting on the RS/6000's traditional strength with scientific and technical customers. The University of Utah in Salt Lake City, for instance, is using an early version of the computer to simulate drug effects.

HP workers will monitor Y2K first hand

THOUSANDS OF Hewlett-Packard employees have been notified that their plans for next New Year have fallen victim to the Y2K bug. The Palo Alto company told the workers to cancel their plans for the celebration and be ready to come to work instead, to help the company manage any Y2K problems that may manifest themselves starting at midnight December 31.

"We've told employees if you work in certain jobs, don't go out and buy a non-refundable plane ticket", said Brad Whitworth, spokesman for the company's Y2K project. "A lot of people are gearing up to handle anticipated customer calls that might be Y2K related." Whitworth said HP is working with its huge customer base to ensure that any Y2K problems are fixed before they become a problem. ❖

Bill Gates donates US$3.5 billion to charity

WAS IT COINCIDENCE, or was it merely way past due that Bill Gates made a serious charitable contribution? As his company was being hammered in federal court, Gates and his wife Melinda donated US$3.5 billion to the two charitable foundations they have founded. In all, the two organizations will control US$5.5 billion worth of assets.

The gift is the largest single donation ever given, and with it, Gates has now given away more money that any other living American. The donation has instantly put the William H. Gates Foundation among the 10 largest charitable groups in the United States. The smaller Gates Learning Foundation also will rank among the top 30 charities.

The William H. Gates Foundation focuses on world health and population problems. Most of its donations are destined for universities and other organizations. The Gates Learning Foundation, formerly known as the Gates Library Foundation, works towards making computers available in public libraries and schools in low-income population centres. The latter organization will use most of the additional income from the new US$1.3 billion donation to broaden its mission into markets outside the United States.

Rather than cash, the gifts were made in the form of about 20 million shares of Microsoft stock. Gates still owns more than 500 million other shares, now worth more than US$70 billion.

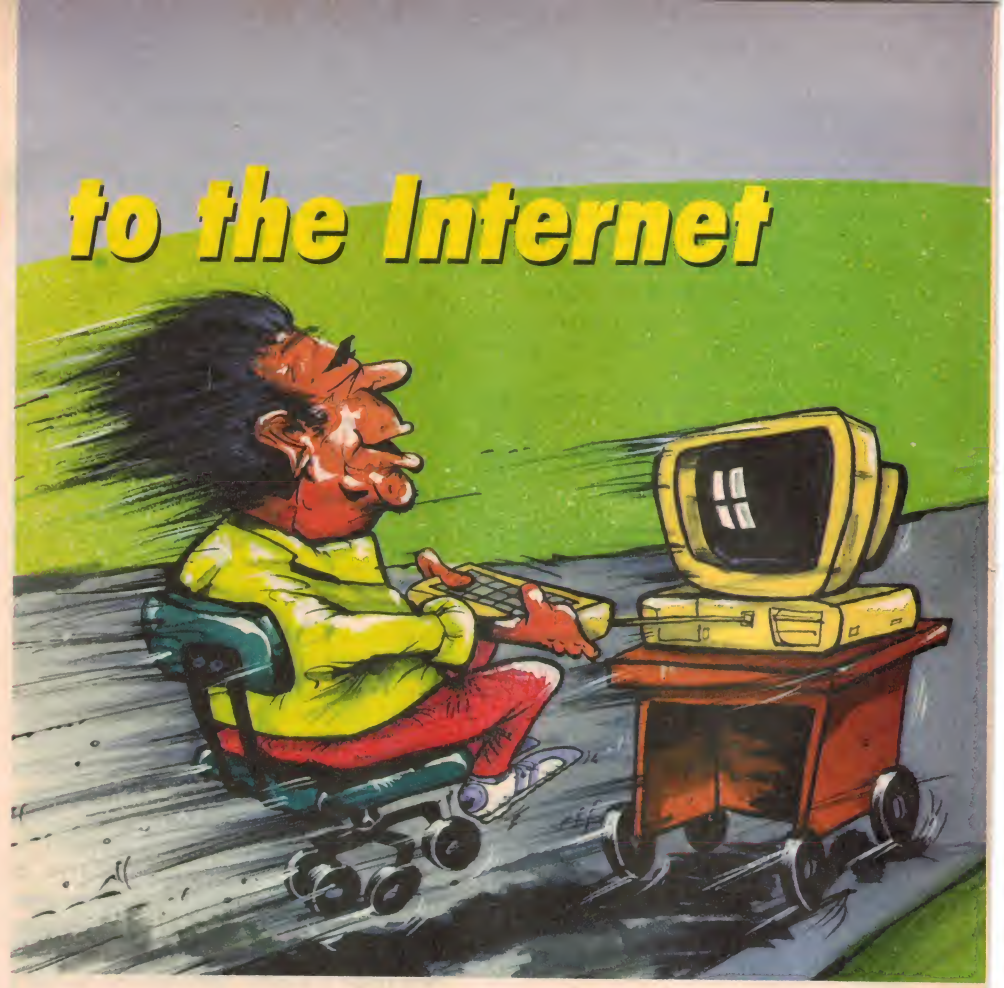
Leaders in the charity community welcomed the large donation, which many felt was long overdue. Gates has been criticized repeatedly over the past several years for not making a more concerned effort to use some of his incredible wealth to contribute to worthy causes.

Hitachi releasing DVD recorder in 2000

THE FIRST recording DVD systems do indeed look likely to hit the market next year, as Japan's Hitachi announced it hopes to be the first Japanese electronics giant to begin shipping a DVD recorder in Japan and the United States by the end of 2000.

Earlier, Holland's Philips Electronics, Europe's largest electronics manufacturer, announced plans to release a DVD recorder in 2000.

Fast Lane to the Internet



You might be on the net, but are you getting your money's worth? In this article, I'll show you how to set up, optimise and troubleshoot your Internet connection, and give you a push start onto the information superhighway.

by Jean-Baptiste Cattley

THESE DAYS, virtually all ISPs (Internet Service Providers) provide instant-setup starter kits with their accounts — but if you don't have the CD to hand, you don't want to install the software they provide, or you just want to see how it all works and how to optimise it, read on.

Before you start, you'll need some information from your ISP: their data phone number, the IP address of their DNS server, the name and port number of their proxy server, your username, and your password. You'll also need a modem, of course, the Dial-Up Networking and TCP/IP system components installed on your system, and an existing account with your ISP. (If some of these acronyms are new to you, look them up in the glossary.)

The first thing to do is to configure a Dial-Up Networking (DUN) connection. Open the Dial-Up Networking folder in My Computer, and double-click the 'Make New Connection' icon to start the New Connection wizard. (If this is your first DUN connection, the wizard will start as soon as you open the folder.) The wizard is pretty self-explanatory, but I'll go through it here anyway:

First, think of a more inspiring name than 'My Connection', and type it into the appropriate box, then select your modem from the dropdown list. If you haven't installed your modem already, the modem installation wizard will be launched. I don't have space to go into the details of that process here, but it's all fairly foolproof, really.

Now type in the ISP's phone number your modem will be dialling, and hit Next, then Finish to create the connection. There's still a little more work to do, but that's as far as the wizard takes you. To finish setting up the connection, right-click the icon for the connection you just created, and hit Properties.

Before we get to the gory details of TCP/IP, we have to set up the modem side of things. Press the button marked 'Configure' in the 'Connect Using' section of the requester. On the 'General' tab, crank the Maximum Speed setting up to the highest speed your serial port can handle. This is usually 115,200 baud for most modern computers, but might be lower on older machines. To check, go to Control panel|Modems|Diagnostics, select your modem and click on 'More Info'. The maximum speed for your serial port should be listed in the top section.

Back in the modem configuration dialogue, move to the 'Options' tab, and tick the box marked 'Bring up terminal window after dialling'. Now hit OK to return to the main properties page, move to the 'Server types' tab and set it up to look like Fig.1. Now click on 'TCP/IP Settings', and unless your ISP told you otherwise, leave the IP address set to 'Server Assigned'. Now select 'Specify name server address', and type the DNS addresses you were given into the two boxes below. Leave the rest as it is, and hit OK to everything.

Theoretically, everything *should* now work. You're only set up for manual login at the moment, but we'll get the basic connection working first. Double-click your new connection, and the modem should dial your ISP. Once that happens, you should see the Post-Dial terminal screen.

What happens next depends on your ISP's setup. Some ISPs go straight into PPP mode, so if you see funny-looking gibberish at this point, you can just hit 'Continue' and you'll

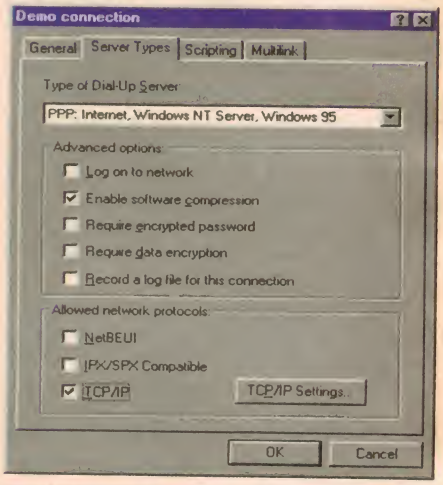


Fig.1: Setting up the various protocols for this connection. It should all look like this or your connection might not work.

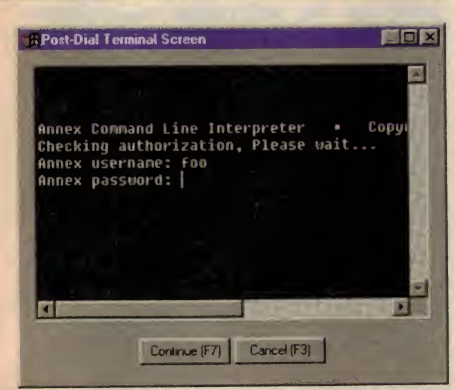


Fig.2: If you are logging on manually, this terminal login window will pop-up asking for your user name and password. If you are feeling ambitious, you can use a simple script (below) to log you in automatically.

Fig.3: A sample login script

```
proc main
waitfor "username:"
transmit $USERID,raw
transmit "^M"
waitfor "password:"
transmit $PASSWORD,raw
transmit "^M"
waitfor "annex:"
transmit "ppp^M"
endproc
```

be connected, so you can go back and uncheck the 'Bring up terminal window...' checkbox for next time. The majority of ISPs, however, use a terminal login, rather like Fig.2, so at this point, you'll need to type in your username and password at the prompts. You may also need to type 'ppp' at the next prompt, if you get one. If in doubt, ask your ISP about terminal logins.

Anyway, at this point you should be seeing funny-looking gibberish, indicating that your PPP connection is ready. Press Continue, or hit F7, and after a few seconds your computer should be connected to the internet. Fire up your favourite web browser and try it out!

Scripts

Now this manual login business is all very impressive, but it can get a bit wearing after a while. What you want is for Windows to enter your name and password for you, automatically. This is where Dial-Up Scripting comes in. Look on the Properties sheet for your connection, and see if it has a 'Scripting' tab. If not, you'll need to get and install it. Go to http://www.microsoft.com/windows95/downloads/contents/wurecommended/s_wunetworking/dun13win95/default.asp and follow the instructions to get the latest version of DUN, which includes Scripting support.

Once you have Scripting, you can create a script to automate your connection. Make a new text file in C:\Program files\Accessories, and rename it to MyScript.scp. Open it in Notepad, and enter the text from Fig.3, editing it to suit your ISP's logon prompts. For example if your ISP asks for 'user ID:' instead of 'username:', you'd want to change line 2 to **waitfor "user ID:"**, and so on.

Lines 8 and 9 are only required if your ISP needs the 'ppp' command after you log on, so you may need to delete them. Save and exit, then go to the Scripting tab of your connection's Properties sheet, hit 'Browse' and select your script. Now go back to the modem configuration screen, and disable the terminal window checkbox, as you don't need it any more.

Next time you connect, you should be logged in automatically, no muss, no fuss. If it doesn't all work smoothly, enable the 'Step through script' box on the Scripting tab so you can see what's going wrong, and edit the script to fix it.

Optimising things

One of the most dramatic speedups you can get for sites you've visited at least once, is to increase the size of your cache folder. Every time your browser requests an object from the web, be it an HTML page, a picture or a background sound, it first checks its local cache folder (aka Temporary Internet Files) to see if it already has a copy, and if so, uses that instead, which is orders of magnitude faster than re-downloading the file from the website.

Obviously, a larger cache means a greater

A Glossary of Internet Terms

.: Pronounced 'dot', the full stop is used to separate the individual components of IP addresses and domain names, which I'll get to in a minute.

@: The 'at' sign, used in email addresses to denote the end of the username and the start of the domain name of the recipient. For example the address fred_bloggs@some.isp.com would send mail to fred_bloggs's mailbox at some.isp.com. Of course, if there were no such user, or no such ISP, the mail would 'bounce' and get returned to the sender.

404: Possibly the most well-known error message in the world today, Error code 404, 'Object Not Found' means that the web page you were attempting to load did not exist. Usually caused by following an outdated link from another web page, or by mistyping a URL.

ASP: Active Server Pages. Microsoftese for Server Side Includes, as used on their Internet Information Server software.

Browser: A program for viewing and navigating pages on the World Wide Web. Examples include Internet Explorer, Netscape Navigator, Lynx, Opera and Arachne.

CGI: Common Gateway Interface. The specification for interfacing software such as search engines and databases to web pages, as featured in the September 1998 issue of Computer Clinic.

com: The single most common domain suffix, used to denote sites of a commercial nature. Other domain suffixes include **edu** for educational institutions, **org** for non-profit organisations, **gov** for governmental bodies, and so on.

Cookies: Small files stored on your computer by the remote web site. Used to hold information about your browsing habits, such as a list of all pages visited at that site. Also used to store authentication information for sites requiring user registration, to save you typing in your password every time. If you don't like the idea of cookies, you can turn off cookie use in the Advanced options menu in Internet Explorer, or the Preferences|Advanced menu in Netscape, but be warned that some sites will not work with cookies disabled.

DNS: Domain Name System. A protocol used to convert domain names to their numerical IP address equivalents. Every time you request a web page by name, such as www.microsoft.com, your computer looks up the name on your ISP's DNS server, which maintains a staggeringly huge database of domain names and their associated IP addresses — in this case 207.46.130.149.

Domain: A named computer or set of computers connected to the internet, such as microsoft.com, which is a lot easier to remember than 207.46.130.149... There are also things called Virtual Domains, which point to individual directories on shared servers. This is, as you might imagine, quite a lot cheaper than a 'real' domain.

DUN: Dial-Up Networking. The Windows 95/98 software component which allows you to connect to the Internet (or alternatively to

chance of finding the file you're looking for. If you are using IE (Internet Explorer), go to View|Internet options->Temporary Files>Settings, or in Netscape try Edit|Preferences|Advanced|Cache->Disk Cache, and wind up the setting. The only real limit on cache size is the amount of disk space you want to sacrifice, but I personally doubt that more than 50MB is going to make much of a difference. If you have a spare partition or drive of less than 100MB that you're not using for anything else, you might like to put your cache there instead of on C:. This has a couple of advantages; writing all those little files to your C: drive means that it'll get fragmented sooner, decreasing system performance, and being small, they take up a lot of slack space on a large drive, which is a terrible thing. Moving the cache to another drive prevents both these problems.

The next thing to do is to set up your proxy server. A proxy server is a computer your ISP uses to store web pages on in order to reduce net bandwidth, rather like a huge version of your disk cache. This is obviously not as fast, but it's often a lot faster than getting the file directly.

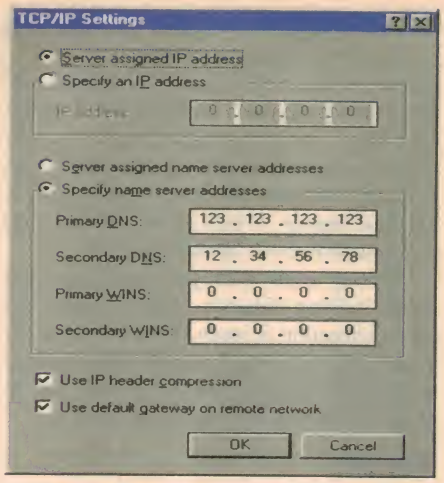
To set up your proxy server, simply type the name and port number of your ISP's proxy server into the View|Internet options|Connection->Proxy server Address box in IE, or for Netscape, select Edit|Preferences|Advanced->Manual, hit View, and type it into each box you see there. Note that proxies don't always speed things up; see the troubleshooting section for more details.

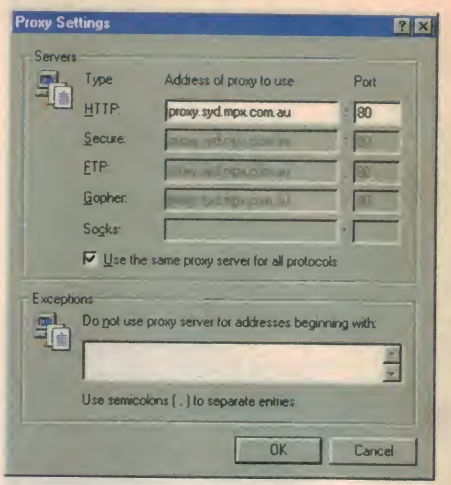
Another thing you might like to try is one of the popular third-party DUN tweaking tools, such as TweakDUN. How these work is quite interesting: briefly put, data sent and received over the internet doesn't travel in one continuous stream, but is broken up into packets for easy routing. Now the default packet size used across the world is 576 bytes, but in their infinite wisdom, the nice people at Microsoft set the default packet size used by Win95 to be 1500 bytes instead.

The upshot of all this is that when your computer requests a web page, it asks for the data to be sent in 1500-byte packets. The remote system obligingly produces these large packets, throws them back at the network, and trusts the routers to get them to you.

Chances are, however, that somewhere along the line a less-flexible router will take one look at the non-standard packet size, and split it up into 576-byte packets. (This process is known as fragmentation, and is a Bad Thing.) As 1500 isn't divisible by 576, the end of the last packet is padded with blanks, which means you could waste about 13% of your bandwidth downloading zeros. The fragmentation process itself also takes time, which can cause the proverbial six-car pileup on the information superhighway. Utilities like TweakDUN set the default packet size to 576, thus avoiding this problem. There are other factors as well, such as the RWIN size, but they are less significant.

Do these programs really work? Well, as with most free lunches, some people report fantastic results, up to double speed in some cases, while others (myself included) don't seem to get any benefit whatsoever. Not every router will fragment packets, and some will use completely different packet sizes anyway, so you really have to take pot luck.





Entering the TCP/IP setting for your connection (left): be sure to use the DNS specified by your ISP, and not the example used here... At right, we are setting up the proxy server — again, use the details supplied by your ISP.

Fig.4: an example HOSTS file

```
127.0.0.1       localhost # The local machine
198.68.239.4    www.eviloverlord.com # An SF parody site
207.46.130.149  www.microsoft.com # Good ol' Microsoft...
```

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another Windows LAN) using your modem. Usually used in conjunction with PPP.

Email: Electronic Mail. The facility for sending private messages to any other person on the internet. All that's needed is an internet connection, an email client such as Outlook Express or Eudora, and the intended recipient's email address, such as kermit@muppets.org.

Flame: An inflammatory or abusive message. For some reason, the text-based nature of most communication over the internet brings out the sociopath in a surprising number of people, and minor disagreements can quickly turn into tremendous torrents of invective. Bizarre, but true.

FTP: File Transfer Protocol. A specification for sending and receiving files over the internet. Just about all browsers these days can handle FTP downloads, but if you want to send files, or the FTP site doesn't accept anonymous FTP requests, you need an FTP client such as CuteFTP or the FTP.exe command that comes with Windows 95.

GIF: Graphics Interchange Format. An image compression format widely used on the internet. The GIF format is better suited to diagrams than to photographs, as it does not handle colour gradients very well.

Gopher: A rather outdated precursor to the World Wide Web. Fairly rare now, gopher sites offer a low-bandwidth text based interface to large amounts of information. Gopher (an American slang term for a lackey, as in go-fer coffee) was originally designed to be used over a text-only terminal, but most web browsers these days can handle the gopher protocol with ease. To see a gopher site in action, surf on over to the seminal gopher server, **gopher://gopher.micro.umn.edu/**.

HTML: HyperText Mark-up Language. The common language of the Web, HTML describes the formatting of text on web pages, from the colour and style of text, to links and complex online forms. HTML was designed to be human-readable; to have a look at some, right-click the page in Netscape or IE and select View Source.

HTTP: HyperText Transfer Protocol. The specification for sending Web pages over the internet. The 'http:' stuck on the front of every URL simply means to use the HTTP protocol to request the data. Other protocols include FTP:, gopher: and news:, for file transfers, gopher menus and usenet news respectively.

IRC: Internet Relay Chat. Rather like a text version of CB radio, IRC provides real-time communication on thousands of *channels* (also known as *chat rooms*). Whatever you type into an IRC client, such as MIRC (**http://www.mirc.com**) will be seen seconds

Also, you should take great care if your computer is part of a LAN. I had installed TweakDUN on my internet box, and discovered that for some reason, file sharing across the network was ridiculously slow. Then it struck me. I was using TCP/IP for file sharing, and every single packet being sent from other computers was the default size of 1500 bytes to start with. These of course had to be fragged down to 576 bytes, causing masses of overhead, which in turn lead to timeouts and resends... Not nice. I could have installed TweakDUN on all my machines, but as it wasn't doing much good anyway, I uninstalled it. It definitely works well for some people, though, so pick up a copy at **http://www.pattersondesigns.com/tweakdun/**, and try it for yourself.

If you're still not satisfied, there's another minor slowdown you can eliminate, or at least reduce: every time your browser requests a file from the web, it must first look up the IP address of the site from your ISP's DNS server. Under less-than-perfect conditions, this can take a second or two per request, so if you are loading a lot of little files, for instance when loading a web page containing a lot of images, this overhead can add up. Not by a whole lot, but if you're looking to get every last bit of performance out of your connection, you can avoid some of your DNS lookups by adding the IP addresses of commonly visited sites to your HOSTS file. Before Windows makes a DNS request, it searches through C:\WINDOWS\HOSTS, and if it finds an entry for the site, it will use the supplied address rather than asking the DNS server.

Of course, before you can add sites to your HOSTS file, you first need to know their IP addresses. There are a number of DNS lookup tools out there, but one of the best I've seen is NetLab, available from **http://members.tripod.com/~adanil/NetLab.html**. Simply type the domain name into the 'Remote Host' box on the DNS tab, and hit Enter. NetLab will then look up the site for you, and spit out the IP address.

Go to your windows directory and look for a file called HOSTS.SAM, (short for SAMple) and rename it to HOSTS in order to activate it. Now open it in Notepad, and add the IP address and domain on a new line. See Fig.4 for an example. Save and exit, and Windows should now use the entry to find the site instead of relying on your ISP's DNS server. Indiscriminate use of the HOSTS file can cause problems, though — see below.

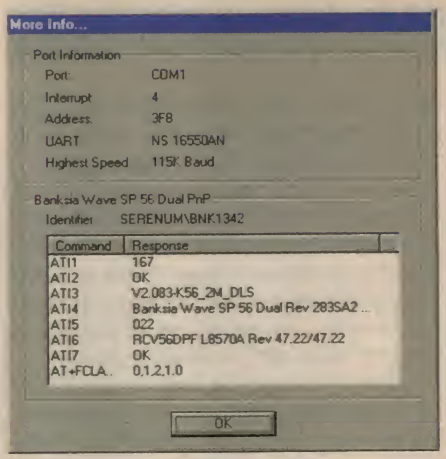
More lunch?

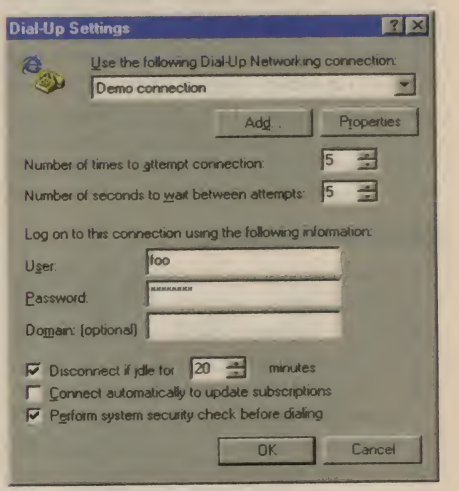
There have recently been a spate of utilities that offer to speed up your internet connection by a huge amount; one even quoted a 12x speed boost! Once again, however, there's no free lunch. Most of these utilities simply run in the background, loading in all the subpages of a website as soon as you arrive at the home page.

If you are the methodical sort, carefully reading and appreciating all the material on one page before moving on to the next, and eventually visiting the whole site, then programs such as these are perfect for you. If you tend to flit about and leave a site before you've even finished the first page, then they merely take up your bandwidth loading in files that you will never see.

Troubleshooting

If you feel that your connection is unreasonably slow, there are a few things you can check: First, make sure that you have the correct drivers for your modem, the maximum speed setting is set correctly, and that nobody has set the flow control to Software in the Advanced Connection settings. You might also want to see if your modem needs any initialisation strings for optimum performance — have a look at **http://www.west.net/~jay/modem/** for a huge list of strings. If you want to use initialisation strings, type them into the Extra Settings box in the Advanced Connection settings dialogue.





Clicking More Info on the modem properties (above) gives you the modem's top port speed. Below is the Dial-up Settings requester, showing that the system will Disconnect if Idle for more than 20 minutes.

Although they're touted as a great speedup

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later by all the other users on that channel, all around the world. While this would seem to be a wonderful form of communication, at least half the channels out there are decidedly non-G-rated, so be prepared...

IP Address: A numeric network address used to uniquely identify every computer on the internet. Usually represented as four eight-bit decimal numbers, separated by dots — e.g., 134.55.234.2

ISP: Internet Service Provider. Any company providing internet access, such as Microplex or Telstra's BigPond.

Java: A computer language developed by Sun Microsystems. Notable for its portability and security, Java is ideally suited to the creation of applets for use in web browsers.

JPG: Joint Photographic experts Group. Pronounced 'jay-peg', the JPG image format is widely used on the Web, mainly for encoding colour photographs. It is excellent at dithering colours, but tends to 'bleed' on sharp edges.

Link: Also known as a Hyperlink, a link is a 'hot spot' on a web page that moves your browser to another page when clicked on.

LRF: Little Rubber Feet. A wonderful TLA, especially useful for confounding computer manufacturers at press releases. Simply ask if their new hardware has LRF support, then sit back and enjoy the confusion.

MTU: Maximum Transmission Unit. The default packet size on any TCP/IP connection.

MUD: Multi User Dungeon. A type of text-based multiplayer fantasy role-playing game played over the internet.

Perl: Practical Extraction and Report Language. The greatest computer language ever written. Used extensively in CGI scripts, perl is the glue that binds the web together. If you're at all into programming, go to **http://www.perl.org** and check it out.

PGP: Pretty Good Privacy. A popular encryption program that produces virtually unbreakable encryption.

PPP: Point-to-Point Protocol. The software protocol used to run networking protocols such as TCP/IP over a serial link, rather necessary for dial-up connections.

Proxy: A go-between computer, used by your ISP to buffer pages off the internet. Also used on local area networks, to allow one internet connection to be shared by many computers.

RAS: Remote Access Service. The Windows NT equivalent of DUN.

Search engine: The only practical way of finding anything on the web. Search engines such as Altavista (**http://www.altavista.com**) and Lycos (**http://www.lycos.com**) read and index thou-

factor, proxy servers can actually slow you down considerably if they start acting up. If the 'Connecting to...' or 'Contacting host...' message on the status bar of your browser consistently takes forever, try temporarily disabling the proxy server settings. If it doesn't help, you should change it back as it will make a difference in the long run, and even if it does help, you should try re-enabling it every so often until it's working properly.

All in all, though, the main cause of poor net performance usually comes down to having too many people on the internet at any one time. Unless you have access to a large quantity of nuclear weapons, your best bet is to simply try and avoid the bottlenecks.

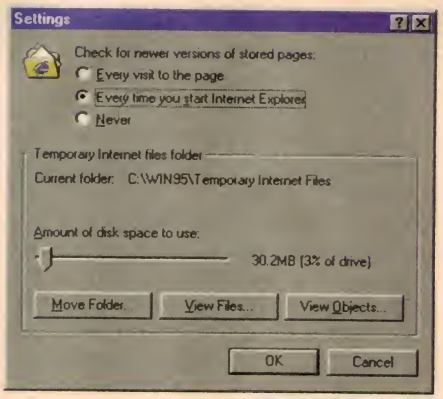
Use local mirror sites where possible, try to cut down on things like streaming audio, Java and animations, and for a serious performance boost, try turning off the pictures altogether. Unfortunately, a lot of sites are completely unusable with the images turned off, but for better-designed sites, the speed gain is enormous. Also, by reducing your total bandwidth, you are helping to make the whole internet that little tiny bit faster for everyone else as well.

Unable to open...

How many times have you clicked on a link, or typed in an address, only to be told that the site couldn't be reached? Well, typos creep in everywhere, and sites move and even disappear — but that's what search engines are for...

If a problem site has an entry in your HOSTS file, try removing the entry, or checking the IP address again. Sites do change IP address from time to time, and if the entry in HOSTS is no longer correct... well, you get the picture.

(A pointless but cute trick is to add a HOSTS entry for one site, such as www.microsoft.com, pointing to a completely different site, such as **http://umweb1.united-media.com/comics/dilbert**. Don't try this at work, kids, or at least don't be around when the IT department cottons on...)



A simple slider lets you control the amount of disk space to use to cache internet files. I'd suggest no more than 50MB, unless you have a spare mini partition left over on your hard drive.

Oh no: a crash!

One of the most annoying things that can happen on the net is for your browser to crash on you. Older browsers such as Netscape 3 for Windows 3.1 have serious problems with a number of Java features, to the point where simply loading some Java enabled pages can cause the whole computer to go down. The only way round this is to disable Java support, upgrade your browser, or simply avoid that page in future.

Internet Explorer does simply crash occasionally, for no obvious reason. This is usually recoverable, but one gotcha is that when Explorer dies, it takes the tray icons with it, including the modem status lights. This can allow you to forget that you are actually still connected, and leave the connection running after you've finished using it. I once lost six hours this way... ouch! If this happens, simply open the DUN folder in My Computer, and double-click the connection icon to bring up the disconnect dialogue box.

A prominent cause of pseudo-lockups, not restricted to web browsers, stems from the fact that modal requesters (that is, ones that halt their parent application until they're answered) can get hidden behind other windows. This can happen, for example, if some versions of Netscape try to play a sound with no soundcard present, or if you send a message in Outlook Express when you're not connected. These requesters don't show up on the taskbar, so the only way to get to them is to Alt-Tab to them. Not actually fatal, but unless you know they're there, you're stuck.

Don't touch that bu...

Finally, one of the most aggravating things to happen when you're online is to suddenly become offline, especially when you're in the middle of a large download. Some ISPs start disconnecting users if all their phone lines fill up, while others have a simple time limit or cut you off if your connection has been idle for more than 20 minutes. There's not much you can do about this, but in the case of idle timeouts, it's probably cheaper to dial again than to be connected for 20 minutes without doing anything.

Of course, disconnections can happen closer to home. Internet Explorer has an AutoDisconnect feature that disconnects you after a given amount of idle time, however its definition of 'idle' is somewhat liberal. Various applications, notably the command line FTP client, don't reset the idle timeout, so if you walk out on a long FTP session, don't be surprised if it dies halfway through. You can turn off AutoDisconnect in View|Internet options|Connection|->Settings.

Outlook Express has a 'hang up when finished' checkbox on its download progress display; if you set this, it's easy to forget about it next time... if you have no mail, your connection can die in three seconds flat!

Call Waiting is another bugbear — those little beeps can really confuse your modem. If you have a number you can dial to disable it, go to Control Panel|Modems->Dialling properties and type it in. Also, if you have an extension handset on your modem line, somebody *will* eventually pick it up at a crucial moment. Come to your own arrangements about this, but I've found that a half-empty box of shotgun shells left next to the phone works wonders... (only joking!) ❖

A Glossary of Internet Terms

sands of websites a day, creating a huge searchable database. You simply type in the words you are looking for, and they will direct you to hundreds of sites matching your query.

Server: Generally speaking, a computer whose primary function is to provide services such as file storage or computation to other computers. On the internet, this usually refers to a web server, used to provide web pages to remote computers.

Spam: Unsolicited advertising or promotional material sent over the internet. The term is derived from the Monty Python Spam sketch, which you can see online at **http://www.stone-dead.asn.au/sketches/spam.htm**. Everybody hates spam, so if you were thinking of starting an email chain letter, don't.

Streaming audio/video: A rather clever idea, really. Rather than having to download all of a multimedia file before you can play it, streaming formats play directly from the net, thus eliminating the wait. For a good example of streaming audio, point your browser at **http://www.abc.net.au/triplej/listen.htm**

TCP/IP: Transmission Control Protocol/Internet Protocol. The network protocols used by every computer on the internet. Not particularly fast, but reliable, configurable and hugely widespread. The Victa mower of the networking world.

TLA: Three Letter Acronym. As you may have noticed, the internet uses an incredible number of these.

URL: Universal Resource Locator. An address used to uniquely identify a document on the web, consisting of a protocol string, such as **http:**, followed by an IP address or domain name, such as **www.adom.de**, followed by a path and filename, such as **/adom/index.shtml**.

WWW: World Wide Web. The massively interconnected set of HTML pages that exists on the internet. The reason that the majority of URLs contain the string **www** is because the web is a fairly recent development, and early web servers on a domain were traditionally called www, to indicate their function. ❖

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Getting connected:

Browsers & ISPs compared

What fuels the massive holy wars between the Netscape crusaders and the IE-vangelists? And what about the competition? You could be excused for thinking it's a two-horse race, but there are some decidedly interesting alternatives in the running. In this article I'll be taking a look at the various browsers available, and helping you to decide which is right for you.

by Jean-Baptiste Cattley

THE PRIME FACTOR in deciding which browser to use is the speed and power of your system. If you have a fairly modern computer, around the Pentium 120MHz mark or higher, then quite frankly, you're best off running either Internet Explorer or Netscape. They sport more features than any other browsers, and they have a huge user-base with lots of support.

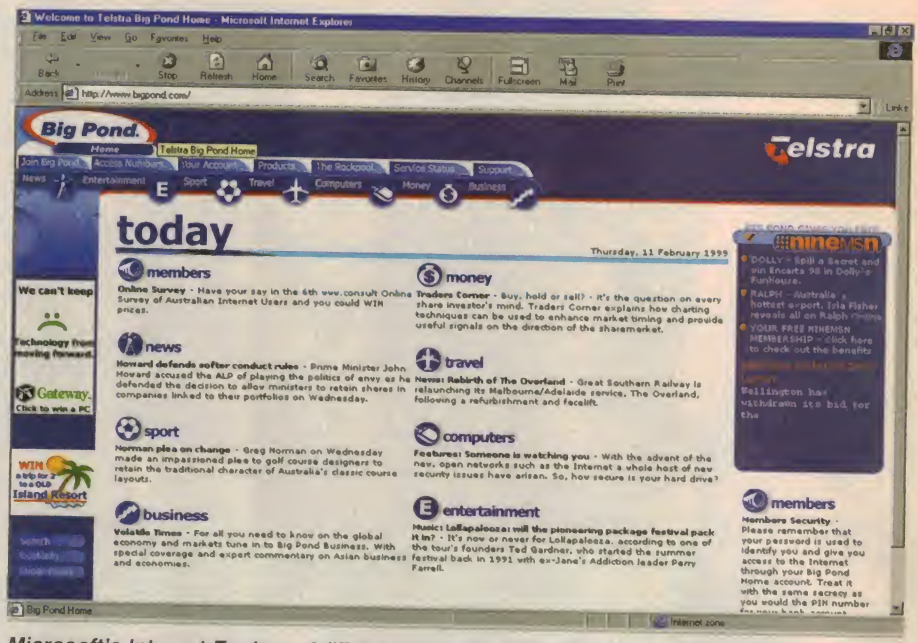
If your system is aging a little, though, then you'd do well to consider one of the lightweight alternatives, such as Opera. Loading the latest versions of Netscape or IE on a 50MHz 486 is something you only do once — before you die of old age...

The Browser wars

While Microsoft have been right on the money in most fields of computing, they didn't foresee the astounding growth of the Web, and thus didn't recognise Netscape as a serious competitor until it was too late. By the time Microsoft developed a browser of its own, Netscape already had a devoted following and quite a respectable market share. The collision of Microsoft's unstoppable force with Netscape's immovable object, and the resulting dirty tricks, name-calling, questionable business practices and lawsuits have generated enough ill-feeling on both sides to start a medium-sized war.

Users on both sides tend to have an unshakeable belief in the superiority of their favoured browser, but when it comes down to it, there really isn't *that* much difference between the two products. Both have borrowed features from each other, so you have to dig a quite bit to find any advantages on either side — that's what comes of thinking like the enemy, I suppose...

Well, that's enough preamble, so on with the show. May I have the first contestant please?



Microsoft's Internet Explorer 4 (IE4) shown here looking at Telstra's Big Pond homepage.

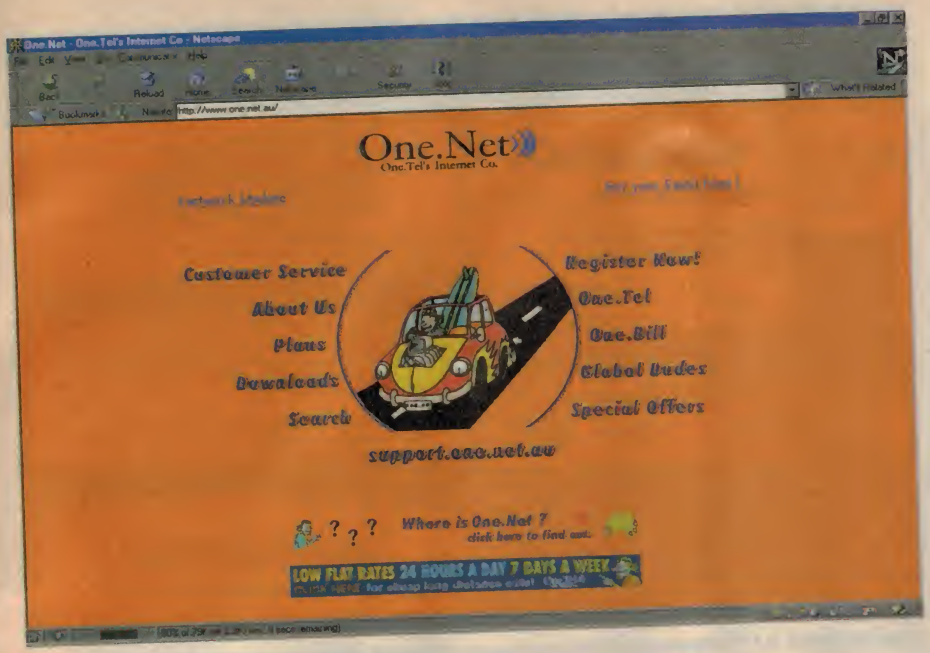
Internet Explorer 4.01

The first thing you notice about IE4 is not the browser itself, but the 'enhancements' it makes to your system. The Active Desktop gives you the rather dubious ability to put Java applets, animated GIFs and other multimedia objects onto your desktop, and to make your whole GUI into a sort of glorified web page.

You even get banner ads in the form of 'channels', a remarkably irritating concept that allows your computer to connect to the internet when you're least expecting it, and clutter up your desktop with web content such as news, sports results and advertising-laced entertainment.

On the plus side, however, you can turn most of these 'features' off while keeping the amazingly useful dockable toolbars, the ability to move, copy and edit shortcuts directly on the Start menu (absolutely brilliant), and the ability to jump directly to any directory by simply typing it into the address bar.

Also, the fiddly little toolbar in Windows Explorer has been bumped up, with a rather handy history function thrown in as well. This is all part of Microsoft's attempt to integrate the web browser with the rest of the GUI, and while it's far from perfect, it certainly makes life easier. If you ask me, the whole emphasis of computing is likely to drift from the concept of separate applica-



And here's Netscape 4 looking remarkably similar... One.Net's page is featured here.

tions into a document-based setup, where everything from database queries to MIDI files use a single common interface. I don't know how long it's going to take to get there, but IE4 is certainly a beginning.

As for the browser itself: well, it does the job well enough. It handles most anything you throw at it, and it generally behaves itself. The only real disadvantage is that it's not terribly... stable. The changes it makes to your system are somewhat drastic, so you simply have to come to terms with the fact that it's going to crash occasionally. Apart from that, it works well, it looks good and it's easy to configure. I wouldn't use anything else, myself, but that's only my personal taste.

Netscape Communicator 4.06

Netscape is a strange beast, a joy to use in some places, and downright infuriating in others. It doesn't try to be anything more than a browser, so the installation is small and your system remains uncluttered — unlike IE, which does weird things to your filesystem, such as creating 'virtual' folders all over the place. Unfortunately, being neat and tidy, it doesn't offer the expansive friendliness shown by IE. Nothing serious, but it sports a collection of minor irritations that detract from its otherwise flawless performance.

For instance, it isn't much good at handling links to local files, and requires special **file://** protocol links. This isn't likely to affect you much in day-to-day use, but if you're building a site locally, it can drive you up the wall.

Netscape's handling of tables and forms is a lot less forgiving than IE's, and any small inconsistencies in page design stick out like a sore thumb. Also, they didn't quite get the 'look and feel' right. The whole application looks rather cheap, as though it were built with a construction kit such as Visual Basic. All in all, what you have is a solid, compact browser that isn't going to die on you — but doesn't make many allowances for the user, either.

Opera 3.51 32-bit

Opera is designed to be small, fast, configurable, and stable, and it certainly is all of these. It may not support all the advanced features of other browsers, but at under 2MB for the entire package, Opera has one of the smallest RAM footprints around, and the 16-bit version will even run well on a 386SX with 6MB! Try doing that with IE...

Also, Opera has a number of features that really make it stand out, such as zoom in/out on the text and graphics of a page, the ability to override colours and backgrounds at the touch of a button (great for hard-to-read pages...), and a handy feature that allows you to open links in the background. This last is useful if you want to check out several links from a search engine; simply shift-control-click, and the link opens in a new window behind the current window. Thus you can scroll down a list of search results, picking off the promising ones, without having to go back all the time.

Opera is hugely configurable, with lots of Accessibility features and visual settings, allowing you to customize the browser to your heart's content. That said, the interface does seem to have been designed to the Windows 3.1 style guide, which makes it hard to take seriously when put next to other 32-bit software. Also, I find the control layout somewhat counter-intuitive. Individual document windows have their own address bar, but most of the control buttons themselves are at the top of the screen, resulting in quite a bit of mousing around.

The worst news of all, of course, is that it's not free. Opera costs US$35 for registration, which while not expensive by any means, is enough to make you reach for Netscape or IE instead, if they work for you. Opera's small size and snappy performance, however, makes it the ideal browser for owners of smaller systems.

Arachne 1.47b

When I first heard of Arachne, I have to admit that I was a bit skeptical. A DOS web browser indeed! I'm not quite sure what I was expecting, but I was very pleasantly surprised.

The Arachne browser for DOS is a fully working web browser, complete with DOS networking utilities to get you connected. There has been a huge amount of work put into Arachne, and it really is shaping up as a serious alternative to the Big Two. The non-Windows GUI and downright weird control structure takes a little getting used to, but I've grown to like it. There are a couple of things to lookout for, however.

Being a DOS application, Arachne simply isn't as fast as Win95 browsers when it comes to rendering a page. Pages that took under 20 seconds to load in IE took over a minute in Arachne. This rendering overhead may well even out on slower machines, but if you have a halfway decent setup (such as my 300MHz K6-2 with 64MB), Windows browsers are always going to beat it to the post. Also, being a DOS application, available conventional RAM is a major concern, and Arachne does have an unfortunate tendency to die on you if it runs out.

Arachne is free for personal, non-commercial use, but any other use attracts a licence fee of $30. All in all, it's a fun piece of software — perhaps not for everyone, but if you're sick of Windows or just want to see what DOS can do if it tries, check it out!

Microsoft didn't foresee the astounding growth of the Web, and didn't recognise Netscape as a serious competitor until it was too late...

QNX demo

The QNX web demo is not designed to be a replacement for your usual web browser, as it is only meant to showcase QNX's internet development package for embedded systems. It is, however, one of the most useful utilities I've come across, as the entire pack-

age fits on a bootable floppy! Simply pop the disk into your PC, boot off it, and in two minutes flat you have a functioning web browser, regardless of operating system and software you might be running.

In fact, the custom operating system that QNX uses doesn't talk to your hard drive at all. This makes saving documents impossible, but it is far outweighed by the convenience of being able to get virtually any PC on the web instantly without changing any settings, taking up any disk space or requiring a functioning OS. In fact, all you need to get it up and running is a 386 with 8MB of RAM, a VGA card, a mouse and some kind of modem. I keep a copy of the QNX demo in with my emergency restore floppies, so no matter what happens I can always get online. Brilliant stuff.

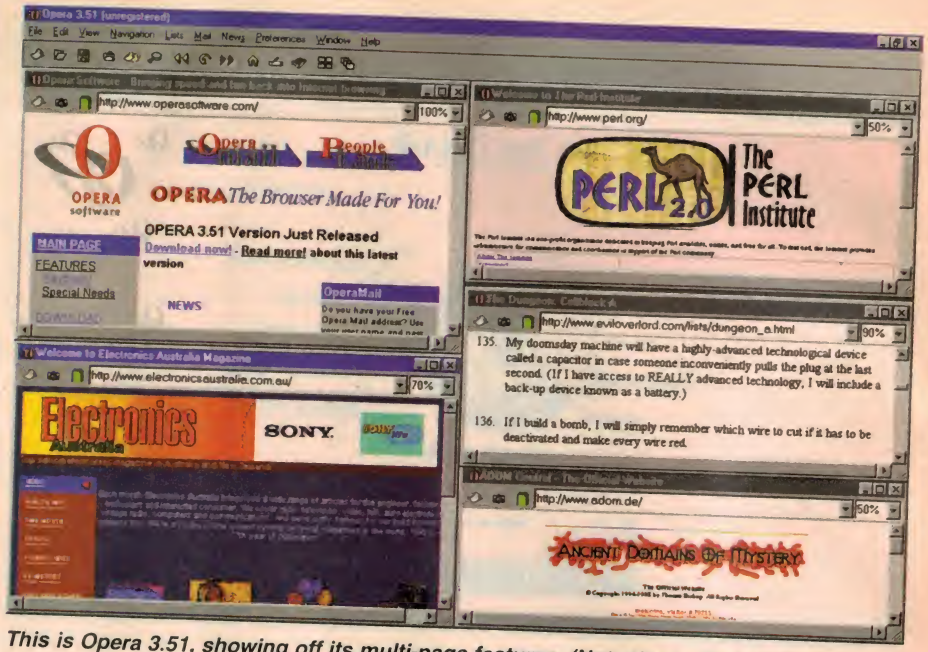
Service providers

Of course, before you can do anything at all on the internet, you need to have an account with an Internet Service Provider or 'ISP'. There are dozens of them out there, but which one to choose? What should you look for?

We don't have the space here to cover every single ISP, so I'm not going to try. Instead I'm going to look at just a few of the more popular national ISPs, and the different approaches and services they offer.

Microplex

Microplex offers an unusual service, in that instead of billing you on a monthly basis, you can purchase online time in advance in the form of 'Access cards', available from leading retailers across Australia including Harvey Norman, Dick Smith Electronics, Grace Brothers/Myers and David Jones, to name but a few. The cards, available in anything from 15 to 100-hour versions come with a starter kit CD, and are very easy to use.



This is Opera 3.51, showing off its multi-page features. (Note the individual speed buttons and address bar in each window).

You simply use the software provided, or surf to their web site and type in the serial number and passwords printed on the card. On average, the price comes to $1 per hour, depending on the amount purchased. The credit in your account expires after 31 days, and unused hours are not reclaimable. If you need more hours, however, you can simply buy a new card and top up your account without incurring any penalties or excess usage rates.

Your email is retained for up to three months after your credit lapses, so you don't have to worry if you miss the shops...

They also run a standard billing system at the same rates, in case you want to pay with your credit card, but no matter which payment option you choose, you get 1MB of free web space with your account, and 24 hour, seven days a week free technical support, which is not to be sneezed at.

Telstra Bigpond

Being the national telephone service provider, Telstra would seem to be the place to go for all your communication needs. Unfortunately, unlike their conventional phone service, Telstra's internet service is not amazingly cheap. Prices on their standard plans range from $1.60 per hour for 80 hours a month, to a startling $3.30 per hour for a maximum of three hours, with excess rates being even higher.

They are, however, currently offering their BIG150 plan, which provides 150 hours per month for just $44, which comes out at about $0.30 per hour. This is a lot cheaper — however conditions apply, such as a five-hour time limit, a 20 minute idle timeout, and the fact that the offer is only available in metropolitan areas. You get 5MB of webspace with your account, although there are bandwidth limits.

One.net

One.net offer a variety of plans, all at quite sensible prices, from their Pocket money plan ($1.95 per hour flat rate, credit card only, email address $19.95 extra) to their Fast Lane plan ($29.95 for 56 hours, then $1.95 per hour, $19.95 setup fee). For the terminal insomniacs out there, $49.95 gets you onto the Big Kahuna plan, which gives you 250 hours or 250MB a month, whichever comes first, then

If you would rather not use windows, then try Arachne. Arachne runs under DOS, and may not as fast as other Windows-based browsers, but it is worth a go, particularly as it is free...

$1.95 per hour or $0.25 per MB downloaded.

They also offer a very useful service, in that you can access your email directly from their web page. This isn't a dodgy webmail service like Hotmail or Yahoo!, rather a way to get to your own private POP3 mail account without the need for a mail client. This is absolutely invaluable if you're on the move, and I'm giving them full marks for creativity. Only limited tech support is available for free, but $9.50 gets you unlimited access to their support line for a period of 72 hours.

CompuServe

CompuServe have been around since long before the Internet boom of the early 90s, and it shows. Having a CompuServe account entails far more than a normal account; you need their own custom interface to access their service, which is like a strange mixture of Viatel, BBS, and internet access.

As well as normal email and web services, they provide a number of user forums and commercial areas, rather like the web in miniature. There are also their 'premium services' — pay-per-view pages on a broad range of topics... a bit odd when you have the rest of the internet for free, but there you go. Their pricing plans are complex, but you can expect to pay anything from $2.00 to $7.00 per hour, depending on the plan you're on.

Liberty One

If you're looking for a simple, no fuss, flat-rate dial-up ISP, then you should take a look at Liberty One. Their standard rate is $5.00 per hour — with no registration fees, no monthly access charges, and no charges for downloading. They also offer two monthly plans, called (appropriately enough) Monthly Plan 1 and Monthly Plan 2. These come in at $19.95 for seven hours and $39.00 per month for 20 hours, respectively. Fees are only payable by credit card, so you'll need one handy when you register. Free technical support is available during business hours.

AOL

AOL originally stands for America On Line, but since their recent arrival in Australia they seem to have quietly re-named the Australian division to Australia On Line...

AOL is a bit like Compuserve, in that they have their own custom browser or 'interface', and they also maintain a number of members-only forums. Their interface doesn't exactly follow the Windows 95 style guide, but it is certainly very easy to use, and is designed for those with little or no computer experience. You can of course use any web browsers or internet tools you want once you are connected, although you do need to use their interface to pick up your mail, as they don't have a POP3 mail server. This makes integration with email capable applications such as Microsoft Outlook a little tricky...

As well as mail, news and web browsing, AOL also provide a service called AOL Instant Messenger, or AIM. This handy little utility keeps track of all the other AIM users around the world, and if any of your 'buddies' are logged on, it pops up a real-time chat window so you can talk to them, putting an end to the game of email tag.

The AOL starter kit includes a 100-hour, 30 day free trial of AOL — but after that, the prices rise dramatically. The standard plan is $9.95 per month for three hours, or 15 hours per month for $29.95, with additional time at $4.00 per hour. This is a little on the pricey side, but you do get a very respectable 10MB of webspace, five email addresses, the use of 1500 points of presence around the world (your account works wherever you go, as long as you can find a computer with the AOL interface installed) and 24 hour, seven days a week worldwide technical support.

All up, AOL is a high-quality service provider backed by an enormous company (they recently bought Netscape Corporation outright...) who aren't about to disappear overnight. The custom interface might annoy the power users out there, but if you are new to the net, or to computers in general, AOL might be just the ticket.

The only real disadvantage with IE4 is that it isn't terribly... stable. It's going to crash occasionally.

Ozemail

Ozemail is arguably the most famous Australian ISP, consistently leading the field in network performance. With 42 points of presence around the country, they offer local call access to over 85% of the population. Such wide coverage comes at a price though: their access rates aren't the lowest, with prepaid plans ranging from $1.50 per hour for 150 hours a month, up to $2.85 per hour for seven hours. Excess usage runs from $3.50 to $5 per hour in peak periods, but is a flat $2.50 per hour from midnight to 7am.

They do have an unlimited-use plan, however, where $44.95 a month will get you unlimited access; and if you buy six months of unlimited access, the price drops to a very reasonable $39.95 a month. These 'unlimited' plans have a six-hour connection limit (fair enough I suppose, unless you are downloading the IE5 beta...), and modem availability is not guaranteed during peak periods. They are not available in all areas, although there is a fair amount of regional coverage. All accounts come with 5MB of web space, and you get 24-hour access to technical support. With such an emphasis on regional coverage, Ozemail is a good choice for anyone living away from the major cities.

Optus Internet

Jumping into the Internet game along with virtually every other telecommunications carrier, Optus Internet offers a prepaid access card system, similar to the one offered by Microplex. This isn't terribly surprising, as Optus have recently acquired Microplex, although the two carriers have no intention of merging their services. The Optus Internet access cards, available from Optus outlets, come in 8, 20 and 30-hour denominations, with the per-hour rate varying from $2.50 an hour to $1.40 per hour. 5MB of web space is included with all accounts, as is 24-hour technical support. They also provide fixed-rate monthly plans, at the same prices, with excess time charged at $3-$5 per hour. ❖

Downloading Browsers

Microsoft IE
http://www.microsoft.com

Netscape
http://www.netscape.com

Arachne
http://arachne.browser.org

Opera
http://www.operasoftware.com

QNX
http://www.qnx.com/iat/index.html

ISP Contacts

Microplex
http://home.mpx.com.au/
- phone (02) 9641-3555

Bigpond
http://www.bigpond.com/
- phone 131 282

One.net.au
http://www.one.net.au/
- Sydney (02)9338 8888,
- Melbourne (03) 9221 8822;
all other areas call 1300 303 312

Compuserve
http://www.compuserve.com.au/
- phone 1300-555-520

AOL
http://www.aol.net.au/
- phone 1800 265 265

Liberty One
http://www.online.libertyone.com.au/
- phone 1800 809 164

Ozemail
http://www.ozemail.com.au/
- phone 132 884

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http://www.optusnet.com.au/
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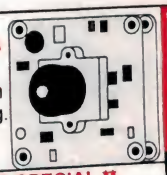

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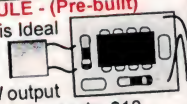
With 1of these lenses (60deg.), 78 deg.; 92 deg.; 120 deg. or for pinhole (150 deg) add $10

MINI AUDIO MODULE - (Pre-built)

This amp/pre-amp is Ideal for use with our cameras. 12Vdc, Hi sensitivity, 0.6W output operation includes electret mic. $10



4 CHANNEL VIDEO SWITCHER KIT

This kit can switch manually or sequentially up to four audio / video sources. Other features inc. VCR relay output to switch STOP/REC, can be switched with PIR or alarm system inputs Add a security channel to your TV using a UHF modulator, watch TV and just flick channels to see who's at the front door or what the Kids are doing in the yard. This unit can be switched automatically using the PIR units below. Kit +PCB + all on-board components inc. 18 relays. For less than Half the price of most units at $50 Optional VHF modulator/mixer $18

MINI PIR DETECTOR PCB MODULE (G66)

Professionally built 30mmX 34mm PIR module with an attached Freznel lens and cable with 4 pin connector Ideal for switching cameras, alarms etc. bargain priced at jist: $18

POWERFUL IR ILLUMINATORS

With strong universal swivel mount & 50X50X50mm housing:10 LED $10... 30 LED $20...80 LED $36

*** CLEARANCE *** HIGH RESOLUTION MONITOR

Brand new 240V 30cm enclosed mono-chrome (green) computer monitor + composite video conversion kit . Kit inc. PCB + all on-board components + monitor. Gives better resolution than TV!

CAR ACCESSARY LIGHTS

With the word (*STOP*) in LEDs $15
With (⟶) in LEDs $15 pair
Bar of 60 Super-bright LEDs, could be used as spoiler mounted brake light. Inc. 2 PCBs 30 LEDS each.
Share one with a friend.just $15

3 Mtr. 10A USED IEC MAINS LEADS

JUST $2 Ea. High quality made for IBM
NEW High quality 2 Mtr. IEC mains extention leads just $6

FREE Ask for a free tunable balanced mini VHF Astec brand Hi quality modulator with any camera order. Connection Diagram supplied

WE BUY NEW & USED SURPLUS STOCK: electronic, mechanical & opto all quantities. Call, Fax or E-mail the details

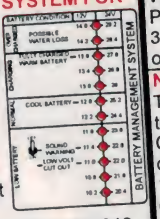
OATLEY ELECTRONICS
PO Box 89 Oatley NSW 2223
Ph (02) 9584 3563 Fax 9584 3561
orders by e-mail: oatley@world.net
www.oatleyelectronics.com
major cards with ph. & fax orders.
Post & Pack typically $6

CURRENT MODEL

YAMAHA LINEAR ROBOTIC ARMS AT 5% OF THEIR ORIGINAL COST , X-RAY MACHINES, HEART MONITORS, SATELLITE TV, TEST EQUIPMENT
These are some of the items that may still be for sale at our Web Site. See our BARGAIN CORNER, TRADERS CORNER & FREE ADS
FREE ADS should be E-mailed with "FREE ADS" in the subject window

KITS OF THE MONTH

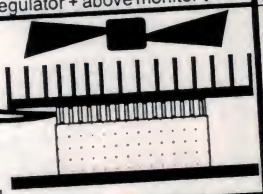
COMPLETE INELEGANT BATTERY / POWER MANAGEMENT SYSTEM FOR THE HOME OR CAR COMING SOON



New Battery Monitor Kit: 12v / 24v monitor with low voltage cut-out, audible alarm before cut-out. This monitor is designed to use minimal power & has a battery saving 12 led bar-graph indicator. Kit inc PCB, all onboard components, label, 10A cut-out MOSFET + suitable surplus case . All for the special introductory price of $32....For 50A MOSFET (IRFZ44) add $3.
SWITCHING REGULATOR KIT: Designed to work with the above system and turns on @13.4V / 26.8V and turn off @13.8V / 27.6V. Kit includes PCB + all on-board components ind. 1x50A MOSFET (space on PCB for to add more MOSFETS) Switching regulator + above monitor $49.

PELTIER EFFECT DEVICES

Make a solid state food cooler / warmer for the car etc. with 2 heatsinks, a fan and one of the following. Could be used for cooling overcolcked PC CPUs
4A △T 65deg. 40 X 40mm Qmax 42W $25
6A △T 65deg. 40 X 40mm Qmax 60W $27.50
8A △T 65deg. 40 X 40mm Qmax 75W $30
Device comes with instructions to build cooler / heater plus data. Some used surplus heatsinks avail.



PELTIER CONTROLLER: This kit is a sw-mode design & correctly controls temp. of peltiers to 10A (very efficient design) PCB + onboard parts + new surplus case. $15

BEST VALUE $1

for our famous wiring kit with any order

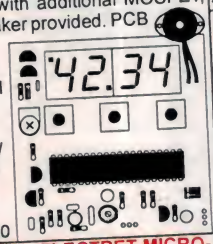
BRIDGE RECTIFIERS 1N60 GERMAINIUM DIODES 10 for $2

MASTHEAD AMPLIFIER KIT SPECIAL

Based on a low noise (2.8dB noise figure) & wide bandwidth (2GHz) amp IC (MAR-6), this kit can be used as an active TV antenna. The PCB is divided into two sections. The PCB can be cut so that the supply board can be indoors. The MAR-6 available separately $4. The amplifier produces good results with any two metal wires or strips acting for the antenna. It should even work with a coathanger ! Basic kit with both the PCBs & all on-board parts (K03) $15 Basic Kit + 2 Weather-proof Plastic Boxes + plug-pack: $24 (ask for your free case with this item)

CLOCK WITH CALENDER AND TIMER

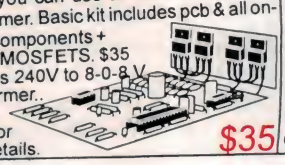
12V DC 12Hr. clock for automotive / domestic/ timer use, large (13mm) Green LED display, AM-PM indicator, Date, Month, 24Hr. Alarm, 59 Min. sleep timer, back up battery. Xtal controlled 50Hz (20ms) clock can also be used for CRO calibration and inverters. Can switch external load during Alarm/timer, 0.5A load directly, or 10A with additional MOSFET, Alarm piezo speaker provided. PCB & all comp's kit: $14 Small Piezo speaker to suit $1 extra. Suitable surplus box + swivel mounting/ +12A mosfet: $4 Full data sheet for LSI IC used (MM5382): $0.80



UNIDIRECTIONAL ELECTRET MICROPHONE: With tie-clip, plug and lead. Aplication notes supplied $4

12VDC - 240AC INVERTER

Features include easily modified to 24V operation, modified square wave output, Auto start with load sensing, Uses six power MOS-FETS with minimal heatsinking required. 200 - 600VA. Dependant on transformer size. To save money you can use an rewind your own transformer. Basic kit includes pcb & all on-board components + 4 X 60A MOSFETS. $35 Requires 240V to 8-0-8 V Transformer.. Ring or E-Mail for More Details.



$35

SHOP MINDER / IR FENCE

IR transmitter & receiver kits (two separate PCB's), basic range is up to 20M but can be greatly increased by adding a lens. Features include output to drive piezo buzzers or relays etc. Two PCB's + all on-board components: $17 Options: 2 suit-able boxes + 2 swivel mounts: $6, Buzzer: $3, 12A relay: $3 (fits on PCB) Lens: $0.80

COMPUTER CONTROLLED STEPPER MOTOR DRIVER KIT

can drive larger motors, Has optolsolation. Inc. Software & notes: $40 Or $50 with two Used 23 frame 200 step 1.8 Deg. motors!!

CHECK OUR WEB SITE FOR DRIVERS

NEW MOSFET VERSION OF OUR 1/2/3 AXIS CNC SYSTEM.

(computer numerical control) This system includes a new stepper motor driver kit (one kit required for each axis) designed to be used with software freely available on the Internet for use with home or professionally built a milling machine, lathe, engraver or cutter etc. with home & limit switches & a high degree of accuracy (can be better than .001". We supply the kit inc. Pcb all onboard parts etc. plus Internet resources shareware software & building or buying mechanical components. Around $40 per axis. Call for details.

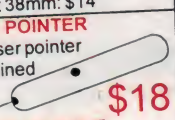
LOOK LOOK** LOOK**

NEW STEPPER MOTORS

30 oz./in. torque, 2.5 deg. 144 step, low voltage, compact 57 x 38mm: $14

KEY-CHAIN LASER POINTER

Very bright 650Nm laser pointer in a high quality machined metal housing



$18

VERY BRIGHT LASER MODULE

650Nm laser module as used in the above pointer. (Lm2)

$14

NSW new laws may apply soon

CIGARETTE LIGHTER PLUG & LEAD

With LED indicator, Fuse and small internal PCB. Space for small projects like voltage regulators etc. 10 for $6

LOW SPEED CRO

This kit connects to your PCs parallel port and will take samples over a 0-2V or 0-20V range. Samples can be taken at intervals ranging from one per hour down to one per 100uS. Useful, for example, to monitor battery charging. It can be used as a basic low frequency (to about 5KHz) oscilloscope! or chart recorder. Our kit includes all onboard components, PCB, case & software on a 3.5" disk: (K90) $27

NICAD CHARGER & DISCHARGER:

Fully built, housed & tested fast NICAD battery charger & discharger PCB. Has 6 ICs, 3 indicator LED's, 3 power MOSFETS, a toroidal inductor & more. Nominal unreg. input 13.7V DC, 900mA charge current. Appears to use volt slope to end charge, and timer to end charge. We supply a thermistor for temp sensing. Probably for fast-charging 7.2V AA nicads. 3 trimpots for adjustment + Basic info. $9 or 3 for $21

NEW DESIGN 110W CFL INVERTER KIT

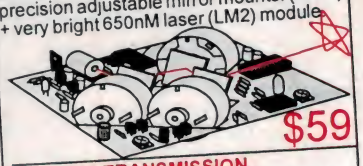
The new improved design uses a larger transformer & a SG3525 switch mode Chip This very Efficient Driver kit can drive up to 11 X 10w CFL's from 12vdc. Great for lighting the week-ender or caravan Kit inc. 1 inverter & 1 CFL: $30 Extra CFLs $12

TELESCOPE Build your own,

with our high quality components: 1 X eyepiece lens worth $5 + 1 X prism worth $12.50 + 1 X large object lens worth $27 + plans all for the price of just $35

NEW SUPER LOW PRICE + LASER AUTOMATIC LASER LIGHT SHOW KIT: MKIII.

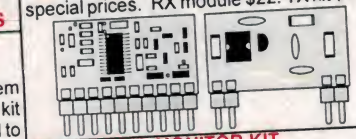
Automatically changes every 5 - 60 secs, & is adjustable. Each motor has 8 speeds, one motor is reversible, & one can stop. Countless great displays from single to multiple flowers, collapsing circles, rotating single and multiple ellipses, stars, etc. Easy mirror alignment with "Allen Key". Kit inc. PCB, all on board comp-onents, three small DC motors, mirrors, precision adjustable mirror mounts: (K115) + very bright 650nM laser (LM2) module



$59

UHF DATA TRANSMISSION

Stamp sized Xtal locked 433.9MHz superhetrodyne receiver module. Small matching transmitter kit:(K122) All at special prices. RX module $22. TX kit $8

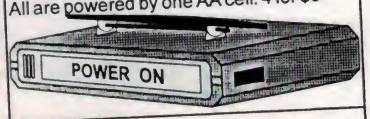


OVERSPEED MONITOR KIT

Ref EA Feb. 97.Gives a signal when preset speed is exceeded. 12Vdc. A small PCB is provided for a Hall Effect pick-up sensor. This is mounted near the drive shaft & connected to the main PCB by three wires. Kit inc. 2 PCBs & all on-board components, a small speaker, & two small powerful 'rare earth' magnets: $22

*****SPECIAL***** POCKET PAGERS

Small modern used pagers, brands inc. LINK, PHILIPS, RTC. condition "unknown", all have two small (grain of wheat) 1.5V lamps and lots of other parts. All are powered by one AA cell. 4 for $5



STROBE KIT

This kit includes small PCB, all on-board components plus a disposable camera. $6

OPTO PACK

A total of 104 opto devices: 94 various colours and types. All top quality brands. Siemens, Kingbright, Kodenshu. All for just $10.

VISIBLE LEDs...5mm
14 X Yellow clear...6 X Red (clear) 24deg....2 X Yellow LED (clear) 24deg. 16 X Red LED (clear) 24deg...38 X Green LED (clear) 24deg.

3mm
14 X Red LED diffused 70deg.
4 X 3mm or rect. Yel. LED diffused 70deg

SPECIAL
1 X 5mm IR LED...3 X 3mm Clear Phototransistor...3 X 5mm Clear Phototransistor...1 X IR Receiver module

Reader Info No 27

READER INFO NO.28

The Power is Yours.

IS ANYTHING POSSIBLE? Yes. With Kodak CD-Recordable writers and media you can create, share and store a massive 650MB of any form of data including audio, video, graphics, pictures and text. EASY? Super-simple to set up and use, inexpensive and discs can be read on any make of CD-ROM drive. TOUGH? Tough enough to last over a hundred years because of the patented Kodak Infoguard™ Protection System in every disc. SUPPORT? Sit back and relax, you'll have all the personalised technical support you need. So, whatever it is you have to do, with Kodak CD-Recordable technology, the choice is yours.

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